802BT/802R Video Test Generator

User Guide

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802BT/802R Video Test Generator, User Guide, Revision A.5 (12/22/04)

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1 Getting Started

Topics in this chapter:

- Product overview
- Operating the generator
- Video interfaces
- Command interfaces
- Special operating modes
- About Video Generator Manager

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Product overview

The generator enables you to test a broad range of video displays including composite or component television video signals as well as computer video display terminals. The generator enables you to quickly set the format appropriate for each display simply by twisting a knob. The generator's functions can be customized to support video display testing in a variety of environments such as development, repair center, or production line.

Standard features

There are over 250 built-in video formats with the generator including VESA, ATSC, EIA-770, SMPTE, NTSC, and PAL. The generator contains a library of over 250 test images which enables comprehensive testing of color, size, linearity, convergence, focus, persistence, and more. You can create custom formats and images, and create test sequences to automatically progress through a list of formats and images for production line environments. You can also configure the generator to continuously loop through the test images.

The generator provides a hot sync feature through the VGA, DVI, or HDMI interface. This feature simplifies format selection by filtering formats in accordance with the Extended Display Identification Data (EDID) it receives and processes from the display.

A probe pulse feature is available on the Special Sync BNC connector. This enables you to trigger an oscilloscope or to synchronize an inspection camera. You can position the leading edge of the probe pulse anywhere within the video frame. This feature facilitates troubleshooting by enabling you to focus on very specific video signal problems occurring anywhere in the video signal. The probe BNC connector can also be configured to output frame sync, line sync, composite sync, or a special probe pulse.

You can control the generator using the front panel knobs and keys, a command line interface, or a Windows-based graphical application called Video Generator Manager (VGM).

The generator supports custom data backup, automatic or on-demand calibration, and downloadable firmware upgrades.

Optional features

Your generator may include one or more of the following options:

- **Digital Visual Interface (Single Link and Dual Link).** The generator can be equipped with a single link or dual link Digital Visual Interface (DVI) transmitter. The DVI transmitter enables testing of DVI compliant video displays. The DVI option includes EDID parsing and a hot-plug, EDID-driven format list.

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- **High Bandwidth Digital Content Protection (HDCP).** Generates HDCP encrypted content for testing DDCP-compliant displays.
- **DVI or HDMI Analyzer.** Optional receiver, which measures pixel errors at different frequencies, measures timing of external sources, and displays EDID from external sources. Can also be used to test cables or distribution systems.
- **High Definition Multimedia Interface (HDMI).** The HDMI feature helps manufacturers increase the likelihood that their products will not only meet compliance standards, but also flawlessly interoperate with other HDMI devices.
- **General Purpose Interface Bus (IEEE-488).** Use to operate the generator in an automated environment.
- **Component video BNC connectors.** The generator can be equipped with R, G, B, VS, and HS/CS BNC connectors.

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Operating the generator

This section describes basic operating procedures. There are four operational interfaces for controlling the generator.

- **Physical controls.** Most of the generator's features and functions are supported using the front panel using the knobs and keys. Functions which are not supported using the front panel include upgrading the firmware, creating and editing formats, creating and editing images and reconfiguring the format and image knob lists.
- **Command line.** An ASCII command line interface, available through the RS-232 port, allows you to send commands either interactively or as command files. All functions are supported by the command line interface except upgrading firmware.
- **Video Generator Manager (VGM).** VGM is a Windows-based application that supports most generator functions using a graphical user interface. When upgrading the generator firmware, VGM must be used.
- **GPIB Programmatic interface (optional).** An IEEE-488 GPIB interface supports the use of the 802 as a programmable video signal source in an automated test evironment. All generator commands are supported through this interface.

Physical controls

The physical controls on the generator consists of the Format knob, Image knob, and eight keys, arranged into four function groups: Image, Video Gate, Sync Gate, and Outputs. All of the keys have built-in indicator lights. When illuminated, a key's function is considered on, or enabled.

Power switch

This rocker switch turns the power on and off. The power supply is auto switching and can handle 110 or 220v.

Format knob

The Format knob is used to select a video signal format from a list of stored formats. A format is a set of parameters that specifies the video and sync signal requirements of a particular timing. Format parameters include timing, sync type, video type, display size, and others. By turning the knob, you can scroll through a list of formats stored in non-volatile memory. The list includes the factory default formats. The knob list can be edited to add custom formats. If a format containing erroneous information is selected, the generator turns off the outputs, and displays an error message.

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Image knob

The Image knob is used to select a test image from a list of stored images. The exact behavior of the knob depends upon the status of the Image key. Turning the knob when the light on the Image key is extinguished scrolls through the main list of test images.

Not all images are supported by all signal formats. Some images in the main image list may be skipped while certain formats are selected. For example, the ColorBar image will be skipped whenever a monochrome format is selected.If the currently selected image cannot be drawn given a newly selected format, the Outline image is automatically drawn after the new format has finished loading.

Some of the image names in the main list may refer to a sub-set of two or more different images. The images in the sub-sets are selected by first selecting the name of the desired sub-set from the main image list. If the sub-set consists of just two images, pressing the Image key will toggle between the two images. The key is illuminated when the second image is showing.

Image Step key

The Image **Step** key determines the behavior of the Image knob in normal operating mode where it is used to select alternate versions of a given test image. The **Step** key will illuminate only when you have selected an image with multiple versions. The following procedure describes how to select image versions.

To select image versions:

1. Using the **Image** knob, select an image that has multiple versions.
2. Press the **Step** key. The key illuminates.
3. Turn the **Image** knob to step through the image versions. As you turn the knob, the image name on the LCD will not change.
4. Press the **Step** key again. The light on the key extinguishes, and the Image knob returns to normal operation.

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R, G, B Video Gate keys

The Video Gate keys activate (turn on) or deactivate (turn off) individual color elements when the generator is in normal operating mode. They also control the addition of primary color information to the NTSC / PAL video outputs on the generator. The following table shows the function of the Video Gate keys, and commands for controlling the key function.

Key	Function	Command
R	Turns all of the red video outputs on and off.	REDG
G	Turns all of the green video outputs on and off. When a 2-bit digital monochrome (MDA) signal is being generated, the G key turns the I (intensity) signal of the video pair on and off.	GRNG
B	Turns all of the blue video outputs on and off. When a 1 or 2- bit digital monochrome signal is being generated, the B key turns the V (video) signal on and off.	BLUG

The master **Outputs** key overrides the settings of these keys when turned off.

ACS, DCS, and DSS Sync Gate keys

The Sync Gate keys are used to activate (turn on) or deactivate (turn off) sync signals when the generator is in normal operating mode. With some formats, more than one type of sync can be selected by pressing two keys together.

Key	Function	Command
ACS	Outputs analog composite sync on one or more of the analog video outputs.	SSST 3; ALLU
DCS	Outputs digital composite sync signal.	SSST 2; ALLU
DSS	Outputs separate digital horizontal and vertical sync signals.	SSST 1; ALLU

The generator selects a default sync type whenever you select a new format. Not all sync types are available with all formats. For example, digital video formats will not allow analog composite sync to be selected. If a key will not illuminate when pressed, then the corresponding sync type is unavailable. Repeatedly pressing a sync gate key causes the selected sync to be toggled on and off. When toggled off, no sync will be sent to the display.

The master **Outputs** key overrides the settings of these keys when turned off.

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Outputs Key

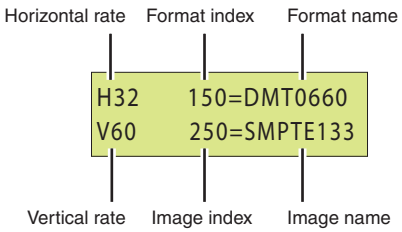
The **Outputs** key turns all signal outputs on or off when the generator is in normal operating mode. This is the master output signal control. When the master output control is turned off, all of the signal outputs (video and sync) of the generator are disabled.

Key	Function	Command
ON	Toggles on and off all video and sync.	OUTG

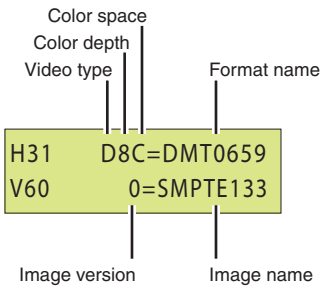
LCD

The generator displays format and image information on the LCD in either of these modes:

- **Default display mode**: This mode displays an index sequence number left of the current format and current image. The image version number, which appears on the display,represents a version of a image that has multiple versions associated with it.



- **Status Display mode**: This mode replaces the index numbers with codes, which provide additional information about the active format. This mode is useful when working with multiple video signal outputs and color encoding methods.



Video types:

- A for analog video
- D for DVI video
- H for HDMI video

Color depths:

- 4 for 4-bits per pixel depth
- 8 for 8-bits per pixel depth

Color space:

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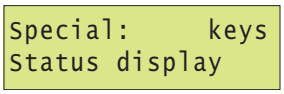
- M for monochrome video
- C for RGB color video
- Y for YPrPb (analog) or YCrCb (digital) with 4:4:4 color sampling
- y for YCrCb (digital) with 4:2:2 color sampling

To use Status Display mode:

1. Turn off the generator.
2. Hold down the **Step**, **G**, and **B** keys while starting the generator, until *status display* displays.



Alternatively, you can set the status display mode by entering the following command:

```
SROP 8; ALLU
```

Determining if the active format has been modified

If the active format has not been modified from the factory setting, then the index number and format name are separated by an equal (=) character. If the active format has been modified, then the index number and format name are separated by a blank space. The blank space indicates that the active format has been modified from the default format definition.

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Video interfaces

This section describes the video interfaces available on the generator.

VGA interface

Use to output analog video for testing analog video displays. The following table describes the VGA connector pinouts.

Pi	Signal	Pin	Signal	Pin	Signal
1	Analog Red Video	6	Analog Red Video Ground	11	No Connection
2	Analog Green Video	7	Analog Green Video Ground	12	DDC/EDID Serial Data
3	Analog Blue Video	8	Analog Blue Video Ground	13	Horizontal Sync
4	No Connection	9	DDC/EDID +5 Vdc Out	14	Vertical Sync
5	Digital Ground	10	Digital Ground	15	DDC/EDID Data Clock

DVI-I interface

Use to output digital video for testing DVI-compliant video displays. Note that the DVI-I connector also provides an analog output which can be used to test analog formats with a VGA to DVI adapter when the generator is in analog friendly mode.

The DVI connector pinouts are shown in the following table.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	TMDS D2-	9	TMDS D1-	17	TMDS D0-	C1	Analog Red
2	TMDS D2+	10	TMDS D1+	18	TMDS D0+	C2	Analog Green
3	D2/4 Shield	11	D1/3 Shield	19	D0/5 Shield	C3	Analog Blue
4	TMDS D4-	12	TMDS D3-	20	TMDS D5-	C4	Horizontal Sync
5	TMDS D4+	13	TMDS D3+	21	TMDS D5+	C5	Analog Ground
6	DDC Clock	14	+5 Vdc	22	Clock Shield		
7	DDC Data	15	Ground	23	TMDS Clock+		
8	No Connection	16	Hot Plug Detect	24	TMDS Clock-		

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LVDS interface

The LVDS connector is located on the front of the generator and is labeled “Digital.” It emulates a digital host video source and is used for testing LVDS-compliant video displays. The LVDS connector pinouts are shown in the following table.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	A0M	10	DDC Clock	19	A0P	28	DDC Data
2	A1M	11	DDC +5 Vdc	20	A1P	29	USB Ground
3	A2M	12	USB+	21	A2P	30	USB-
4	Clock 1M	13	USB +5 Vdc	22	Clock 1P	31	Shield Ground
5	A3M	14	A4M	23	A3P	32	A4P
6	Shield	15	A5M	24	No Connection	33	A5P
7	No Connection	16	A6M	25	No Connection	34	A6P
8	No Connection	17	A7M	26	No Connection	35	A7P
9	No Connection	18	Clock 2M	27	DDC Ground	36	Clock 2P

HDMI interface

The HDMI connector is located on the front of the generator and is labeled “HDMI.” It emulates an HDMI-compliant video display. The HDMI connector pinouts are shown in the following table.

HDMI Type A Connector Pinouts (HDMI option only)

Pin	Signal	Pin	Signal	Pin	Signal
1	TMDS Data 2+	7	TMDS Data0+	13	CEC
2	TMDS Data2 Shield	8	TMDS Data0 Shield	14	Reserved (N.C.)
3	TMDS Data2-	9	TMDS Data0-	15	SCL
4	TMDS Data1+	10	TMDS Clock+	16	SDA
5	TMDS Data1 Shield	11	TMDS Clock Shield	17	DDC/SEC Ground
6	TMDS Data1-	12	TMDS Clock-	18	+5 V Power

Special Sync (S/S) interface

Use the S/S connector to output frame sync, line sync, composite sync, or a special probe pulse. For more information, see Chapter 12, “Using Special Sync Output.”

S-Video interface

If you have chosen the TV option your generator will have an S-Video connector on the right side labeled “SVIDEO.” This is a miniDIN connector that emulates an S-Video compliant source for outputting composite TV signal.

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Composite video BNC

If your generator is equipped with the TV option, it will have a composite TV BNC connector on the right side, labeled “TV.” This interface emulates an analog composite TV source.

Component video BNC interface

Your generator can be optionally equipped with separate R. G, B, HS/CS, and VS BNC connectors on the right side. These interfaces emulate component a analog video source.

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Computer interfaces

This section describes the RS-232, GPIB, and USB interfaces.

RS-232 interface

Each generator has a standard RS-232 serial connector, labeled “Serial.” This is a 9-pin D-Sub male connector which enables you to connect the generator with a computer. A null modem cable is provided to support this interface. You can communicate with the generator either through the command line interface from a telnet session or from the Video Generator Manager (VGM) application. The pinouts for the RS-232 connector are shown in the following table.

Pin	Signal	Pin	Signal	Pin	Signal
1	Data Carrier Detect	4	Data Terminal Ready	7	Request to Send
2	Received Data	5	Signal Ground	8	Clear to Send
3	Transmitted Data	6	Data Set Ready	9	Ring Indicator

GPIB interface (optional)

The GBIP interface allows you to use the generator as a programmable video signal source in a larger automated test system. Generators that have the GPIB interface option have two rotary switches for setting the GPIB address. These switches are accessible through the ventilation slots. The GPIB connector pinouts are listed in the following table.

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	DIO1	7	NRFD	13	DIO5	19	Shield
2	DIO2	8	NDAC	14	DIO6	20	Shield
3	DIO3	9	IFC	15	DIO7	21	Shield
4	DIO4	10	SRQ	16	DIO8	22	Shield
5	EOI	11	ATN	17	REN	23	Shield
6	DAV	12	Shield	18	Shield	24	Signal Ground

USB interface

Use the USB interface for downloading bitmap images from a computer. With VGM 4.0 or later, the USB interface can be used in place of the serial interface.

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PCMCIA interface

Use the PCMCIA card slot to back up your custom configurations, transfer configurations and settings from one generator to another, and store bitmap images.

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Command interfaces

The common test applications can be accomplished through the physical controls or through the command line interface. The generator supports an ASCII command and query language that allows you to control the generator interactively or through batch processing of command files. All generator functions are supported through this interface. The command interface is available through two physical interfaces: the RS-232 interface and the optional IEEE-488 GPIB interface.

The GPIB interface supports programmatic control in an automated test environment, which is discussed in more detail in Chapter 7, “Using GPIB Interface.” This interface also supports user interactive command sessions.

The procedures for using the RS-232 interface are explained in this section.

Setting up a terminal connection with the generator

The following procedures describe how to setup a terminal session with the generator using the RS-232 interface.

To setup a terminal connection with the generator:

Whenever the generator is powered on, the baud rate returns to 2400 bps, no parity, 8 data bits, 1 stop bit, and no handshake.

1. Connect the RS-232 cable between your computer or terminal and the serial connector on the generator.
2. Using a terminal emulator, such as HyperTerminal, establish a terminal connection with the generator. Configure the terminal emulator to use the following parameters:
   - 2400 baud rate
   - 8 data bits
   - 1 stop bit
   - no parity
   - no handshaking
   - full duplex
3. Press the Enter key until the R:> prompt appears.

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Changing the baud rate

The RS-232 interface can be configured from the physical controls to support faster baud rates and to supprort a remote keypad (optional accessory). The default configuration is 2400 baud. When the generator is powered on, the baud rate returns to the default configuration.

To support file transfers, you can change the baud rate of the port to 38400 bps using the command line interface or 9600 bps using the physical controls.

To increase the baud rate using the command line interface:

1. At the R:> prompt, enter the following command:

   ```
   MODE 38400 n, 8, 1, h, n
   ```

   After you press Enter, the terminal emulator will lose its connection with the generator, which is now set at a different baud rate.

2. Close the terminal emulator session, change the baud rate to 38400, and then re-open the session, specifying the baud rate as 38400.

To change the baud rate to 9600 using the front panel:

1. Turn off the generator.
2. Hold down the R and DCS keys while starting the generator. The serial port is now set to 9600 bps. Restarting the generator again, without pressing any keys, will

Sending commands interactively

This procedure describes how to send commands through an interactive user session. The generator parses command lines one at a time. Command lines must be terminated with a carriage return (<cr>). The generator immediately echoes each character as it is received and places it in a command line buffer. When sending multiple commands at once, separate each command with a semi-colon. Commands are not case sensitive.

To send single commands to the generator:

1. Establish a terminal session with the generator (see page 14).
2. At the R:> prompt, enter commands or queries and terminate with a carriage return.

Command examples

- To display the name of the format currently in the format buffer, enter:

  ```
  FMTL?
  ```

- To load a format, enter:

  ```
  FMTL format_name
  ```


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- To apply the format to the generator hardware, enter:

  `FMTU`

- To load an image, enter:

  `IMGL image_name`

- To apply the image to the generator hardware, enter:

  `IMGU`

To send multiple queries and commands to the generator:

1. Establish a terminal session with the generator (see page 14).
2. At the R:> prompt, enter the queries or commands, separating each with a semi-colon and terminating the command line with a carriage return.

Command examples:

- To query the current format and then load a new format enter the following:

  `FMTL?; FMTL new_format; FMTL? FMTU`

  The generator will return the following in response to this command and query string:

  `current_format; new_format`

- To change the format and image active in the generator enter:

  `FMTL 480p59; IMGL SMPTEbar; ALLU`

  This tells the generator to load the 480p59 format named “” into the format data buffer, the image named “SMPTEbar” into the image data buffer, and then to “use” the contents of both (“all”) buffers to drive the generator's output.

Sending commands from text files

When developing more complex, custom test sequences or formats, it is easiest to enter commands in a text file, and then send the file to the generator. This approach allows you to modify the file without entering the entire command script.

To send a text file to the generator:

1. Using a text editor, enter the commands that define a test sequence or format into a text file, and save the text file using a *.txt extension.
2. Establish a terminal session with the generator (see page 14).

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3. At the R:> prompt, transfer the text file to the generator. For example, to transfer a file using HyperTerminal, do the following:

   a. On the **Transfer** menu, click **Send Text File**. The **Send Text File** dialog box appears.

   b. Select the text file you want to send, and then click **Open**. HyperTerminal displays the commands as they are sent.

   c. Press **Enter** once to ensure that the last command is sent.

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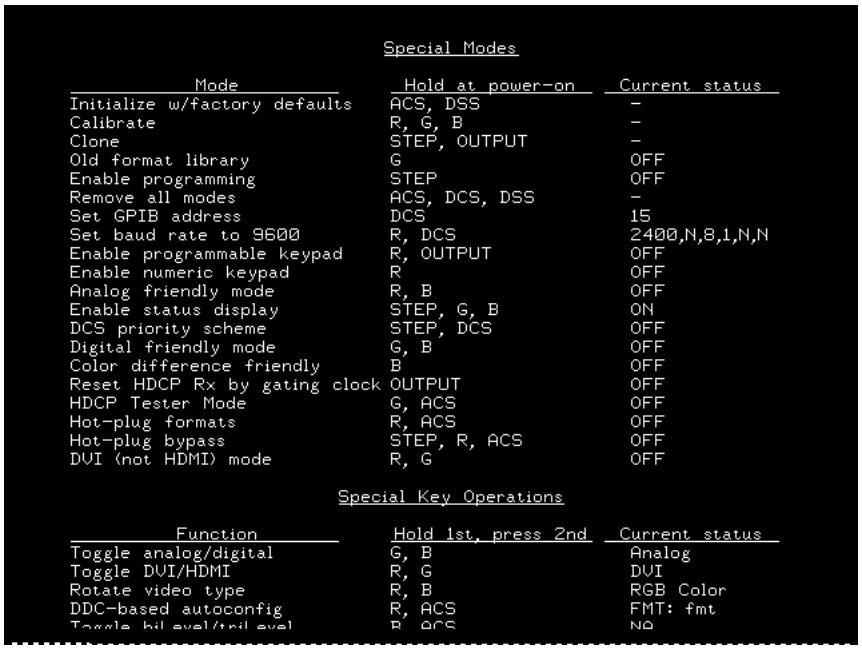
Special operating modes

You can set the generator to operate in various modes to accomplish specific functions. When any special operational mode is set, it persists (until overridden) throughout subsequent power cycles, which may be performed to set other modes.

You can view the operational settings and special functions of the generator on a video display by viewing the GenOps image. This image provides key sequences and the status of special operating modes in the generator.

To determine the status of operating modes:

1. Connect the appropriate interface cable to the video display.
2. Using the **Format** knob, select a format suitable for the display.
3. Turn the **Image** knob to select the GenOps image.



Special Modes

Mode	Hold at power-on	Current status
Initialize w/factory defaults	ACS, DSS	-
Calibrate	R, G, B	-
Clone	STEP, OUTPUT	-
Old format library	G	OFF
Enable programming	STEP	OFF
Remove all modes	ACS, DCS, DSS	-
Set GPIB address	DCS	15
Set baud rate to 9600	R, DCS	2400,N,8,1,N,N
Enable programmable keypad	R, OUTPUT	OFF
Enable numeric keypad	R	OFF
Analog friendly mode	R, B	OFF
Enable status display	STEP, G, B	ON
DCS priority scheme	STEP, DCS	OFF
Digital friendly mode	G, B	OFF
Color difference friendly	B	OFF
Reset HDCP Rx by gating clock	OUTPUT	OFF
HDCP Tester Mode	G, ACS	OFF
Hot-plug formats	R, ACS	OFF
Hot-plug bypass	STEP, R, ACS	OFF
DVI (not HDMI) mode	R, G	OFF

Special Key Operations

Function	Hold 1st, press 2nd	Current status
Toggle analog/digital	G, B	Analog
Toggle DVI/HDMI	R, G	DVI
Rotate video type	R, B	RGB Color
DDC-based autoconfig	R, ACS	FMT: fmt
Toggle hi level/tri level	B, ACS	NO

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Summary of special modes

The following table describes the special operating modes, and how to configure the modes using the physical controls or the command line interface.

Special mode	Function	Physical control	Command
Initialize with factory defaults	Re-initializes generator to factory defaults. Removes all special modes, deletes all custom objects.	ACS, DSS	INIT
Calibrate	Calibrates the generator.	R, G, B	SCAL SROP 32
Clone	Copies configuration settings from one generator to other generators using a PCMCIA card.	Step, Outputs	Set: SROP 64 Rst: SROP 0 64
Old format library	Displays old format names on LCD.	G	Set: SROP 1 Rst: SROP 0 1
Remove all modes	Removes all special modes.	ACS, DCS, DSS	Set: SROP 0
Set GPIB address	Sets the GPIB address.	DCS	Set: GPIB ***addr*** Rst: INIT
Set baud rate to 9600	Sets baud rate of RS-232 port to 9600 bps.	R, DCS	Set: SROP 256 Rst: SROP 0 256
Enable programmable keypad		R, OUTPUT	Set: SROP 512 Rst: SROP 0 512
Enable numeric keypad	Enables remote operation through remote keypad.	R	Set: SROP 128 Rst: SROP 0 128
Analog friendly mode	Causes all digital formats to output analog video signal.	R, B	Set: SROP 4 Rst: SROP 0 4
Enable status display	Provides additional information on LCD (analog/digital and color depth).	Step, G, B	Set: SROP 8 Rst: SROP 0 8
DCS priority scheme	Changes priority scheme for putting CS on separate VS and HS sync outputs when any digital composite sync (DCS) type is selected	Step, DCS	Set: SROP 4096 Rst: SROP 0 4096
Digital friendly mode	Causes all analog formats output digital signal	G, B	Set: SROP 2 Rst: SROP 0 2
Color difference friendly	Outputs digital YCbCr for television formats.	B	Set: SROP 2048 Rst: SROP 0 2048
Reset HDCP Rx gating clock	Resets the receiver, and gates off transmitter clock and data.	Outputs	Set: SROP 16 Rst: SROP 0 16

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Special mode	Function	Physical control	Command
HDCP tester mode	Enables HDCP testing.	G, ACS	Set: SROP 8192 Rst: SROP 0 8192
Hot plug formats	Auto-configures generator format knob list based on EDID in response to hot plug.	R, ACS	Set: SROP 16384 Rst: SROP 0 16384
DVI mode (disable HDMI)	Outputs DVI on HDMI connector.	R, G	Set: SROP 32768 Rst: SROP 0 32768
Hot plug bypass	Bypasses hot plug detection and auto-configuration of the generator.	Step, R, ACS	Set: SROP 65536 Rst: SROP 0 65536

Special key operations summary

The following table describes modes that can be enabled while the generator is running, and the physical controls and comands for using the modes.

Mode	Function	Physical control (hold 1st & press 2nd)	Command
Toggle analog/digital	Outputs either digital or analog.	G, B	AVST x; DVST x
Rotate video type	Outputs either RGB, color difference, or monochrome.	R, B	
DDC-based auto-configuration	Auto-configures generator format knob list based on EDID.	R, ACS	
Toggle biLevel/triLevel	Toggles between tri-level and bi-level syncs for analog HDTV formats with tri-level sync type.	B, ACS	TSPG x

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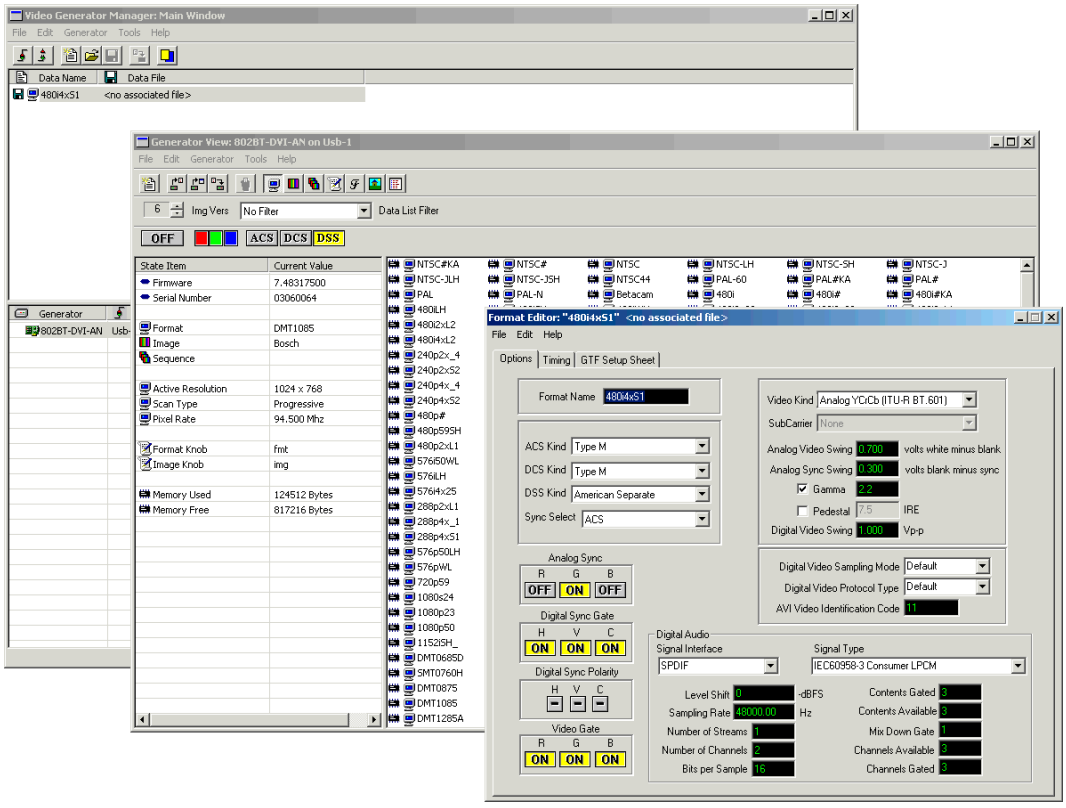
About Video Generator Manager

Video Generator Manager (VGM) is a Microsoft Windows-based program used to operate the generator from a computer.



VGM features

VGM supports the following functions.

- Creating custom test sequences.
- Creating customized Image or Format knob lists.
- Creating custom formats or modifying existing formats.
- Creating custom images or modifying existing images.
- Archiving custom data.
- Upgrading the generator firmware.
- Re-initializing a generator.
- Calibrating a generator.
- Downloading a bitmap image to a generator.

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For information about using VGM, see the VGM online help.

Installing VGM

VGM is available on the Resource CD included with the generator, and from http://www.quantumdata.com/support/downloads/.

To install VGM:

1. Log onto Windows with Administrator privileges.
2. Do one of the following:
   - On the Resource CD, double-click the **setup.exe** file to begin the installation.
   - On the Quantum Data Web site, click the **setup.exe** file to begin the installation.
3. Follow the on-screen instructions.

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2 Testing Video Displays

Topics in this chapter:

- General video display testing procedure
- Testing analog computer (IT) CRTs
- Testing digital computer (IT) FPDs
- Testing analog composite video SDTV (CE) CRTs
- Testing analog component video SDTV (CE) CRTs
- Testing digital component video HDTV (CE) flat panel displays

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General video display testing procedure

This section provides an overview of the video testing process, which involves connecting the generator to the display under test, selecting a format appropriate for the display, and then selecting images to exercise the display to ensure proper functioning.

Making physical connections

Use the following table to connect the generator with display under test.

Display type		Signal type	Cable
Information Technology (IT)	Computer - VESA (DMT, CVT)	Analog component RGB	VGA to VGA
	Computer - VESA DDWG	Digital component RGB	DVI to DVI
Consumer Equipment (CE)	SDTV - ITU-470-6 base-band	Analog composite CVBS	BNC to RCA 75 Ohm
	SDTV - ITU-470-6 base-band	Analog composite S-Video	S-Video (miniDin to MiniDin)
	SDTV - CEA-861B	Analog component YPbPr	VGA to RCA[1]
	HDTV - CEA-861B	Digital component DVI RGB	DVI to DVI, or HDMI to DVI
	HDTV - CEA-861B	Digital component HDMI RGB and YCbCr	HDMI to HDMI

1. Optional cable available from Quantum Data.

Setting the video output mode

If the application involves testing similar displays with one type of video signal output for extended periods of time (for example, in a production environment), use one of the following modes:

- **Digital Friendly mode** – Digital formats are output without change, while analog formats are temporarily switched to digital. This mode is available only if the generator has a digital option (DVI, LVDS, or HDMI) installed.
- **Analog Friendly mode** – Analog formats are output without change, while the digital formats are temporarily switched to analog.

For information about using these modes, see “Summary of special modes” on page 19.

When you need to test various video signal outputs and color encoding methods (for example, in a repair center), disable all friendly modes, and enable the Status Display mode (see “LCD” on page 7) so that you can determine the current configuration. Then,

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hold down the G key while pressing and releasing the B key to switch between digital and analog outputs. The table below shows the AVST and DVST command settings for analog and digital outputs.

Video Signal Interface	AVST	DVST
Analog YYY Grayscale	1	0
Analog RGB Color	2	0
CVBS or S-Video Grayscale	3	0
CVBS or S-Video Color	4	0
Analog YPbPr SDTV Color	6	0
Analog YPbPr HDTV Color	7	0
Digital YYY Grayscale	0	9
Digital RGB Color	0	10
Digital YCbCr SDTVColor	0	13
Digital YCbCr HDTV Color	0	14

Selecting video formats

This section explains how to configure the generator to output video formats that are supported by the device being tested.

Note: *You can create your own formats. See "Creating custom formats" on page 63 for details. Additionally, you can create your own Format knob lists. See "Editing Format knob lists" on page 67 for details.*

Selecting formats automatically

When testing EDID-compatible displays, the generator can automatically update the Format knob list (list of format names shown on the LCD) to include only formats supported by the display under test. Depending on the output used, the generator can do this on demand, or automatically when a display is connected.

To update the Format knob list on demand:

1. Connect the display you want to test with the generator.
2. Hold down the **R** key, and then press and release the **ACS** key. This puts the generator into either Analog Friendly or Digital Friendly mode based on the EDID that the generator receives.
3. Turn the Format knob to choose a format. Only formats supported by the display are listed.

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To update the Format knob list automatically when a display is connected:

1. Connect the display you want to test with the DVI or HDMI connector on the generator. (Analog outputs do not support this feature.)
2. Turn the generator off.
3. Hold down the **R** and **ACS** keys while starting the generator, until *hot plug formats* displays on the LCD.

   Note: *The generator is now in Digital Friendly mode.*

4. Turn the Format knob to choose a format. Only formats supported by the display are listed.
5. Connect a different device to automatically update the Format knob list again.

Selecting formats manually

When testing a display that is not EDID-compliant, you must manually choose formats from the generator that are supported by the display.

To do this:

- Identifing the type of display (composite television, component standard definition television, component high definition television, computer equipment, or other specialty display).
- Check the specifications of your display for supported formats.
- Learn how the format library is organized, and how formats are named (see below).
- Turn the Format knob to try formats from the appropriate format category. Try the DMT0660 (VGA) format if you are not sure of which formats to use.

Understanding the format library

After connecting the generator with the display under test, turn generator on, and select a video format.

This section describes how to choose a video format, from the list of formats built into the generator, for the display you are testing. A format defines a set of video, timing and sync parameters for a specific device or standard.

A summary of the format naming convention is provided. For a detailed description of the naming conventions, see to “Format naming conventions” on page 56.

Organization of format library

The generator has several built-in formats to test a broad range of display types. These formats are grouped in the following categories:

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- Composite television formats
- Component standard definition television formats
- Component high definition television
- Computer display formats
- Military and medical display formats
- Miscellaneous formats

When you turn the Format knob, the formats are listed in the order shown above.

Composite television formats

Composite television formats are named by the standards defining them. The first three to five characters of the format name indicate the color coding scheme. The first set of characters refers to the standard. The next characters are optional and indicate adjustments to the format. Examples of these formats are:

- NTSC (North American TV)
- PAL (European TV)
- NTSC-J - (where J refers to a Japan standard per NTSC without 7.5 IRE setup)
- PAL-N (where N indicates 3.58205625 MHz color sub-carrier)
- PAL# (where # indicates that the sampling rate is reduced to achieve square pixels)

Component standard definition television formats

Component SDTV formats are applicable in the case of RGB, YPbPr. These formats are named by their vertical resolution, scanning method, and frame rate. The initial characters indicating the resolution are followed by the scanning method. The two characters following the scanning method indicate the frame rate. A typical example of component standard or definition TV video format is:

- 480i2x30 (for a vertical resolution of 480 pixels with interlaced scanning and a 30 Hz frame refresh rate; 2x indicates that the pixels are double-clocked for DVI compatibility).

Component high definition television formats

Component high definition television formats, like the standard definition television formats, are named by their vertical resolution, scanning method, and frame rate. These formats are applicable in the case of RGB, YPbPr, and YCbCr. These initial characters indicating the resolution are followed by the scanning method. The two characters following the scanning method indicate the frame rate. A typical example of component high definition TV video format is:

- 1080i30 (for a vertical resolution of 1080 active vertical lines with interlaced scanning and a 30 Hz frame refresh rate).

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Computer display formats

Computer display formats are assumed to use progressive scanning. Computer format names consist of four blocks. The initial three characters indicate the vendor ID using the EISA ID (for example, IBM, SUN, and VSC) or the standard body or acronym (for example, SMT, DMT, GTF, CEA, and EIA). The next two characters provide the first two digits of the horizontal resolution in pixels. Following the horizontal resolution are two characters which indicate the frame rate. The final character indicates the aperture, which is used only if the aperture is not 1.33 (A). The following are examples of computer display formats:

- VSC1275 for Viewsonic 1280 by 1024 at 75 Hz
- DMT0685 for Discrete Monitor Timing with 680 by 480 at 85 Hz

Viewing format parameters

You can use the Format image or VGM to view detailed information about formats in the generator.

To view formats parameters using VGM:

- Open each format in the Font Editor.
- Generate a detailed format listing.

  Refer to the VGM online help for instructions.

Selecting images

Once you have determined the format or formats appropriate for testing the display you will apply a series of images suitable for evaluating the display. Of primary importance is determining what type of display you are testing (for example, CRT or digital flat panel display). You must also determine if you are testing composite TV and use images appropriate for these formats and video types.

Each image in the generator's library is intended to test one or more attributes of a particular display type and video type.

Note: *You can create your own images. See "Creating custom images" on page 75 for details. Additionally, you can create your own custom Image knob lists. See "Editing Image knob list" on page 81 for details.*

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The table below provides a summary of display characteristics and the images used to evaluate them. For details on the images and display attributes, see Appendix B, "Image Reference."

Display type	Display test	Recommended images
Analog CRT	Geometry (pin and barrel, linearity)	Static images Hatch (TVHatch, Hatch_16, Hatch_20), CirclesL, Geom_1 - Geom_5, SMPTE133
	Focus	Focus_@6, Focus_@7, Focus_@8, Focus_@9, Text_9, Text_9T, Text_11, Text_12T, Text_16
	Photometry (chrominance, contrast, levels)	Flat, Flat07, Flat13, Flat20, Flat27, Flat33, Flat40, Flat47, Flat53, Flat60, Flat67, Flat73, Flat80, Flat87, Flat93, FlatGray, Flat_01, Flat_02, Flat_03, Flat_04, Flat_05, Flat_06, Flat_07, Flat_08, Flat_09, Flat_10, Flat_11, Flat_12, Flat_13, Flat_14, Flat_15, Flat_16, Ramp_B, Ramp_G, and Ramp_R, ColorBar, SMPTEbar, TVBar100 & TVBar_75 (TV formats only)
	Luminance	SMPTE133 (grayscale), Grays5, Grays9, Grays11, Grays16, Grays32, Grays64
	Gamma correction	SMPTE133 (checkerbox)
	Resolution	BurstTCE, Burst (TV formats only), Grill_11, Grill_15, Grill_22, Grill_33, Grill_44
	Pulse (CE SDTV)	PulseBar
	Centering	Outline0, Outline1, Outline2, Outline3
	Voltage Regulation	Regulate
	Electromagnetic Interference	EMITest1, EMITest2, EMITest3, EMITest4, EMITest5

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Display type	Display test	Recommended images
Digital flat panel (fixed pixel display)	Pixel anomalies (stuck pixels, misc sampling)	Flat, Raster, Ramp_B, Ramp_G, and Ramp_R, Focus_@6, Focus_@7, Focus_@8, Focus_@9, Text_9, Text_9T, Text_11, Text_12T, Text_16
	Photometry (chrominance, contrast, levels)	Flat, Flat07, Flat13, Flat20, Flat27, Flat33, Flat40, Flat47, Flat53, Flat60, Flat67, Flat73, Flat80, Flat87, Flat93, FlatGray, Flat_01, Flat_02, Flat_03, Flat_04, Flat_05, Flat_06, Flat_07, Flat_08, Flat_09, Flat_10, Flat_11, Flat_12, Flat_13, Flat_14, Flat_15, Flat_16, Ramp_B, Ramp_G, and Ramp_R, ColorBar, SMPTEbar, SMPTE133
	Luminance	SMPTE133 (grayscale), Grays5, Grays9, Grays11, Grays16, Grays32, Grays64
	Centering	Outline0, Outline1, Outline2, Outline3
	Resolution	BurstTCE, Grill_11, Grill_15, Grill_22, Grill_33, Grill_44
	Persistence	Animated images: Persist, Cubes, SlideX

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Testing analog computer (IT) CRTs

This section describes how to test analog computer (IT) displays.

To test an analog computer CRT:

1. Use a standard VGA cable to connect the VGA connector on the generator with the VGA connector on the display under test.
2. Calibrate the generator by holding down the **R, G** and **B** keys while starting the generator. See “Calibrating the generator” on page 47.

   You can also calibrate the generator by entering the following command:

   ```
   SCAL
   ```

   When calibrating the generator, if you load the analog outputs (as they will be loaded when conducting testing) then the calibrations will be slightly more accurate. This is not required however. Also, loading the unused outputs with 75 ohms will optimize signal damping.
3. (Optional) Enable the Status Display mode and Analog Friendly mode (see “Special operating modes” on page 18). The Analog Friendly mode ensures that the generator will output an analog signal. The Status Display mode enables you to view the current output characteristics on the LCD.
4. Determine the formats to test (see “Selecting formats automatically” on page 25).
5. (Optional) To view the EDID on the display, use the **Image** knob to select the EdidData image and follow the directions on the display. You may wish to view the EDID data to verify that the formats required for testing are specified in the EDID.

   Alternatively, you can load the image with the following command:

   ```
   IMGL EdidData; IMGU
   ```
6. Determine additional formats to test based on the resolution of the display. The VESA formats are shown below:

Standard	Quantum Data format name
VGA	DMT06xx
SVGA	DMT08xx
XGA	DMT10xx
SXGA	DMT12xx
UXGA	DMT16xx
QXGA	DMT20xx
QSXBA	DMT25xx

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Determine the images to test:

For analog CRTs you typically want to select images to test for geometry, focusing, photometry, resolution, cross talk, EMI, and regulation characteristics. For more details on what images test these specific display attributes, see “Selecting images” on page 28 or Appendix B, “Image Reference.”

Verify the test set-up:

1. Using the **Format** knob, select one of the formats you have identified.

   Alternatively, you can load the format with the following command:

   ```
   FMTL format_name; FMTU
   ```

2. Using the **Image** knob, select a suitable image such as ColorBar. Verify that the display is presenting the image to ensure that the generator is sending a valid signal to the display.

   Alternatively, you can load the image with the following command:

   ```
   IMGL ColorBar; IMGU
   ```

Test the display:

1. Using the **Format** knob, select the first test format identified.

   Alternatively, use these commands to load the format:

   ```
   FMTL format_name; FMTU
   ```

2. Using the **Image** knob, select the first test image.

   Alternatively, you can also load an image with the following command:

   ```
   IMGL image_name; IMGU
   ```

3. Repeat steps 1 and 2 for all formats and test images. Use the following guidelines to verify proper operation:

   - When testing geometry with the Hatch images (for example, Hatch20) look for distortion with concave or convex lines near the periphery of the display. Look for irregular spacing on the cross hatch patterns.
   - When testing photometry such as chrominance, use the ColorBar, SMPTE133, or SMPTEbar images. Look for missing bars which may indicate a dead or unconnected channel. Also, look at the transition between the bars; they should be sharp and distinct. Each bar also should be uniform in color and intensity across its entire width.
   - To test luminance, you can use the SMPTE133 (grayscale portion) image. To test gamma correction, you can use the SMPTE133 (checkerbox portion) image. The detailed methods for verifying these parameters on the SMPTE133 image are provided in Appendix B, “Image Reference.”
   - When testing focus with the Focus or Text images, the characters in all areas of the display should be well-formed and in focus.

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- When testing resolution with the Grill images, you should be able to see individual and distinct stripes in all areas of the display at all four resolutions.
- When testing for centering use the Outline images. For detailed methods for verifying centering with the Outline images, see Appendix B, “Image Reference.”
- When testing for high voltage regulation with the Regulate image, observe the outline at the edges of the image. They should stay in place and not pull away from the area of the large white blinking patch (when it appears).

Note: *You can customize your generator to run through a specified set of formats and images automatically or manually by creating test sequences. See to “Creating a test sequence” on page 87 for details.*

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Testing digital computer (IT) FPDs

This section describes how to test digital computer (IT) displays.

To test a digital FPD:

1. Use a DVI-I cable to connect the DVI output on the generator with the DVI connector on the display under test.
2. Place the generator in Digital Friendly mode by holding down the **G** and **B** keys while starting the generator.

   Alternatively, you can set the Digital Friendly mode by entering the following command:

   ```
   SROP 2 4; ALLU
   ```

   The Digital Friendly mode ensures that the generator will output a digital signal on the DVI connector, when selecting analog formats from the format library.
3. Determine the formats to test. Auto-select the formats to test by enabling the generator's DDC-based auto configuration. See "Selecting formats automatically" on page 25 for instructions.
4. (Optional) To view the EDID on the display, use the **Image** knob to select the EdidData image and follow the directions on the display. Verify that the EDID specifies the formats required for testing.

   Alternatively, you can load the image with the following command:

   ```
   IMGL EdidData; IMGU
   ```
5. Determine which images to test. For digital flat panel displays, you typically want to select images to test for pixel anomalies, persistence, photometry and resolution related problems. For more information, see "Selecting images" on page 28 or Appendix B, "Image Reference."

Verify the test set-up:

1. Using the **Format** knob, select one of the formats you have identified.

   Alternatively, you can load the format with the following command:

   ```
   FMTL format_name; FMTU
   ```
2. Using the **Image** knob, select a suitable image such as SMPTE133. Verify that the display is presenting the image to ensure that the generator is sending a valid signal to the display.

   Alternatively, you can load the image with the following command:

   ```
   IMGL SMPTE133; IMGU
   ```

Test the display:

1. Using the **Format** knob, select the first test format identified.

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2. Using the **Image** knob, select the first test image.
3. Repeat steps 1 and 2 for all formats and test images. Use the following guidelines to verify proper operation:
   - When testing photometry such as chrominance, use the ColorBar, SMPTE133, or SMPTEbar images. Look for missing bars which may indicate a dead or unconnected channel. Also, look at the transition between the bars; they should be sharp and distinct. Each bar also should be uniform in color and intensity across its entire width.
   - To test luminance, you can use the SMPTE133 (grayscale portion) image. To test gamma correction, you can use the SMPTE133 (checkerbox portion) image. The detailed methods for verifying these parameters on the SMPTE133 image are provided in Appendix B, "Image Reference."
   - When testing for centering use the Outline images. The detailed methods for verifying centering with the Outline images (Outline0, Outline1, Outline2, Outline3) are provided in Appendix B, "Image Reference."
   - When testing resolution with the Grill images, you should be able to see individual and distinct stripes in all areas of the display at all four resolutions.
   - When testing for pixel anomalies use the Flat, Raster and Ramp images. Use the Raster and Flat images to look for pixels that may be stuck On or Off, respectively. The luminance should increase uniformly for the Ramp image. Also, look for sparkles indicating problems with sampling.
   - When testing for persistence with the animated images (for example, Cubes and Persist), look for bleeding or trails in the wake of the moving object.

   Note: *You can customize your generator to run through a specified set of formats and images automatically or manually by creating test sequences. See "Creating a test sequence" on page 87 for details.*

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Testing analog composite video SDTV (CE) CRTs

This section describes how to test CRT composite televisions with analog composite video inputs.

To test analog composite video SDTV:

1. Use a standard coax cable to connect the TV BNC connector on the generator with the display under test.

   Or, use an S-video cable to connect the SVIDEO connector on the generator with the S-Video input on the display under test.

2. (Optional) Place the generator in Analog Friendly mode by holding down the **R** and **B** keys while starting the generator (see “Special operating modes” on page 18).

   The Analog Friendly mode ensures that the generator will output an analog signal.

3. Determine which composite television standard you need, such as NTSC or PAL, and then select the formats compatible with the standard. Typically, you would test all the formats in the family of formats for a standard.

4. Determine the images to test. For analog CRTs you typically want to select images to test for geometry, focusing, photometry, resolution, cross talk, EMI, and regulation characteristics. For more details on what images test these specific display attributes, see “Selecting images” on page 28 or Appendix B, “Image Reference.”

Verify the test set-up:

1. Using the **Format** knob, select the first NTSC or PAL format.

   Alternatively, you can load the format with the following command:

   ```
   FMTL format_name; FMTU
   ```

2. Using the **Image** knob, select a suitable image such as SMPTEBar. Verify that the generator is sending a valid signal to the display and that the display is presenting it.

   Alternatively, you can load the image with the following command:

   ```
   IMGL SMPTEBar; IMGU
   ```

Test the display:

1. Using the **Format** knob, select the first test format.

2. Using the **Image** knob, select the first test image.

   Note: *You can customize your generator to run through a specified set of formats and images automatically or manually by creating test sequences. See “Creating a test sequence” on page 87 for details.*

3. Repeat steps 1 and 2 for all formats and test images. Use the following guidelines to verify proper operation:

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- When testing geometry with the Hatch images (for example, TVHatch and Hatch20) look for distortion with concave or convex lines near the periphery of the display. Look for irregular spacing on the cross hatch patterns.
- When testing photometry such as chrominance, use the TVBar100 & TVBar_75 (TV formats only), TVSplBar, SMPTE133 or SMPTEbar images. Look for missing bars which may indicate a dead or unconnected channel. Also, look at the transition between the bars; they should be sharp and distinct. Each bar also should be uniform in color and intensity across its entire width.
- When testing focus with the Focus images, the characters in all areas of the display should be well-formed and in focus.
- When testing resolution with the Grill images, you should be able to see individual and distinct stripes in all areas of the display at all four resolutions. When testing for resolution with the Burst image, the peak intensities of the all of the bursts should match the white reference level. The darkest portions between the peaks should match the black reference level.
- When testing for centering, use the Outline and TVoutLin images. The detailed methods for verifying centering with the Outline images (Outline0, Outline1, Outline2, Outline3) are provided in Appendix B, “Image Reference.”
- When testing for high voltage regulation with the Regulate image, observe the outline at the edges of the image. They should stay in place and not pull away from the area of the large, white blinking patch (when it appears).

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Testing analog component video SDTV (CE) CRTs

This section describes how to test CRT televisions with standard definition component video inputs.

To test an analog component video SDTV display:

1. Use a VGA-to-RCA cable to connect the VGA connector on the generator with the YPbPr inputs on the display under test.

   Or, if your generator has optional component BNC connectors, use a BNC to RCA cable to connect the BNCs on the generator with the RCA connectors on the display under test.

2. Identify the component television formats to test. These formats are listed after the composite television formats in the generator's default Format knob list. Begin with the first format in the range of standard definition component television formats (480i).

3. Determine additional formats to test based on the resolution of the television display. The television specification sheet will provide information on what resolutions to test. It is necessary to test only those resolutions with the supported scanning type (typically, interlaced for a standard definition television).

4. Determine the images to test. For analog CRTs you typically want to select images to test for geometry, focusing, photometry, resolution, cross talk, EMI, and regulation characteristics. For more details on what images test these specific display attributes, see "Selecting images" on page 28 or Appendix B, "Image Reference."

Verify the test set-up:

1. Using the **Format** knob, select the first component video format (480i).

   Alternatively, you can load the format with the following command:

   ```
   FMTL 480i; FMTU
   ```

2. Using the **Image** knob, select a suitable image such as SMPTE133. Verify that the generator is sending a valid signal to the display and that the display is presenting it.

   Alternatively, you can load the image with the following command:

   ```
   IMGL SMPTE133; IMGU
   ```

Test the display:

1. Using the **Format** knob, select the first test format.

2. Using the **Image** knob, select the first test image.

   Note: *You can customize your generator to run through a specified set of formats and images automatically or manually by creating test sequences. See "Creating a test sequence" on page 87 for details.*

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3. Repeat steps 1 and 2 for all formats and test images. Use the following guidelines to verify proper operation:

   - When testing geometry with the Hatch images (for example, TVHatch and Hatch20), look for distortion with concave or convex lines near the periphery of the display. Look for irregular spacing on the cross hatch patterns.
   - When testing photometry such as chrominence, use the TVBar100 & TVBar_75 (TV formats only), ColorBar, SMPTE133 or SMPTEbar images. Look for missing bars which may indicate a dead or unconnected channel. Also, look at the transition between the bars; they should be sharp and distinct. Each bar also should be uniform in color and intensity across its entire width.
   - To test luminance you can use the SMPTE133 (grayscale portion) image. To test gamma correction you can use the SMPTE133 (checkerbox portion) image. The detailed methods for verifying these parameters on the SMPTE133 image are provided in Appendix B, “Image Reference.”
   - When testing focus with the Focus or Text images, the characters in all areas of the display should be well-formed and in focus.
   - When testing resolution with the Grill images, you should be able to see individual and distinct stripes in all areas of the display at all four resolutions.
   - When testing for centering use the TVOutline and Outline images. The detailed methods for verifying centering with the Outline images (Outline0, Outline1, Outline2, Outline3) are provided in Appendix B, “Image Reference.”
   - When testing for high voltage regulation with the Regulate image, observe the outline at the edges of the image. They should stay in place and not pull away from the area of the large white blinking patch (when it appears).

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Testing digital component video HDTV (CE) flat panel displays

This section describes how to test digital component video for HDTV flat panel displays.

To test a digital (DVI) component video HDTV display:

1. Use a standard DVI cable to the DVI connector on the generator and then to the DVI connector on the television display under test.

   Note: *If the display under test has a DVI-D connector you will need a DVI-I to DVI-D adaptor.*

2. Place the generator in Digital Friendly mode by holding down the **G** and **B** keys while starting the generator (see “Special operating modes” on page 18).

   This mode ensures that the generator outputs a digital signal on the DVI connector, even when selecting analog formats from the format library.

3. Identify the high definition component television formats to test. These formats are listed after the composite television formats in the generator’s default Format knob list. Begin with the first format (720p) in the range of high definition component television formats. See “Selecting formats automatically” on page 25.

4. Determine additional formats to test based on the resolution of the television display. The television product specification sheet will provide information on what resolutions to test. It is necessary to test only those resolutions with the supported scanning type (typically interlaced for a high definition television).

5. Determing which images to test. For digital television flat panel displays, you would typically want to select images to test for pixel anomalies, persistence, photometry and resolution related problems. For more details on which images test these specific display attributes, see “Selecting images” on page 28 or Appendix B, “Image Reference.”

Verify the test set up:

1. Using the **Format** knob, select the first HDTV video format (720p50).

   Alternatively, you can load the format with the following command:

   ```
   FMTL 720p50; FMTU
   ```

2. Using the **Image** knob, select a suitable image such as the SMPTE133 image. Verify that the generator is sending a valid signal to the display and that the display is presenting it.

   Alternatively, you can load the image with the following command:

   ```
   IMGL SMPTE133; IMGU
   ```


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Test the display:

1. Using the **Format** knob, select the first test format.
2. Using the **Image** knob, select the first test image.

   Note: *You can customize your generator to run through a specified set of formats and images automatically or manually by creating test sequences. See "Creating a test sequence" on page 87 for details.*

3. Repeat steps 1 and 2 for all formats and test images. Use the following guidelines to verify proper operation:

   - When testing photometry such as chrominence, use the ColorBar, SMPTE133, or SMPTEbar images. Look for missing bars which may indicate a dead or unconnected channel. Also, look at the transition between the bars; they should be sharp and distinct. Each bar also should be uniform in color and intensity across its entire width.
   - To test luminance, you can use the SMPTE133 (grayscale) images. To test gamma correction, you can use the SMPTE133 (checkerbox) image. The detailed methods for verifying these parameters on the SMPTE133 Image are provided in Appendix B, "Image Reference."
   - When testing for centering, use the Outline images. The detailed methods for verifying centering with the Outline images (Outline0, Outline1, Outline2, Outline3) are provided in Appendix B, "Image Reference."
   - When testing resolution with the Grill images, you should be able to see individual and distinct stripes in all areas of the display at all four resolutions.
   - When testing for pixel anomalies, use the Flat, Raster, and Ramp images. Use the Raster and Flat images to look for pixels that may be stuck On or Off, respectively. The luminance should increase uniformly for the Ramp image. Also look for sparkles indicating problems with sampling.
   - When testing for persistence with the animated images (Cubes and Persist), look for bleeding or trails in the wake of the moving object.

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3 Administrative Tasks

The chapter describes how to accomplish common administrative tasks. Most administrative functions are supported through the front panel or command line interface. However, upgrading firmware can only be achieved through VGM; it is not supported through the front panel. Most administrative functions are supported through the VGM application. See the VGM online help for information on performing these administrative tasks through VGM.

Topics in this chapter:

- Displaying system information
- Restoring factory settings
- Calibrating the generator
- Cloning generators
- Installing firmware
- Memory management

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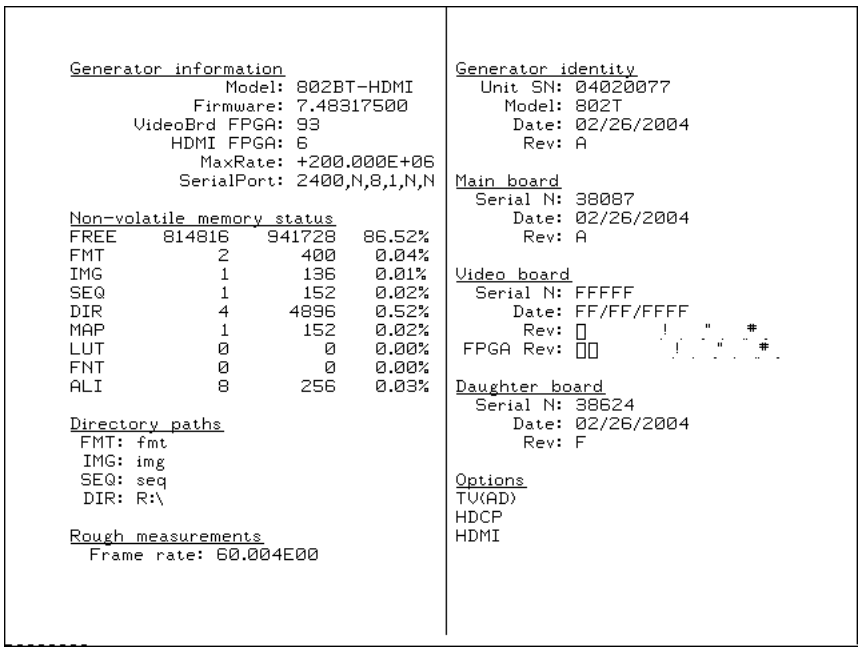
Displaying system information

Use the GenStats image to display information about the generator, including revision levels of FPGA software installed. This image also list installed options.

To display information about generator:

1. Connect the generator with a display.
2. Choose a format supported by the display.
3. Turn the Image knob to select the GenStats image.



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Restoring factory settings

This section describes how to set and restore the generator system parameters.

System Parameters

The following system parameters are stored in the 802's non-volatile system memory:

- The reference rate calibration factor. The 802 uses a crystal controlled oscillator as the reference for all timing signals. The crystal frequency has a maximum error of ±50 ppm. The 802 hardware and firmware is capable of compensating for this small amount of error by applying a user set calibration factor. The factory default setting is 1.000 for the calibration factor. Use the `RATC` command to set the pixel calibration factors.
- The maximum pixel clock rate used for error checking formats. All 802 generators will operate, to some extent, at pixel rates beyond their spec sheet limits. The maximum rate can be set to a higher limit if it is known that a particular unit will work reliably at the higher limit. Use the `JRAT` command to set the maximum pixel rate used for error checking of analog formats.
- The gamma correction flag. This flag determines whether individual formats can control the application of gamma correction or if gamma correction is disabled regardless of a format's setting. The factory default setting is to allow gamma correction to be controlled by individual formats. Use the `GAMC` command to enable or disable the gamma correction flag.

Setting and restoring system parameters

There are two ways of changing the settings of these parameters:

- They can be restored to their default factory settings as part of a user initiated system reset. This will also restore the entire format storage memory to its factory default contents.
- A suitably equipped computer or terminal connected to one of the communications ports can be used to set the parameters to user defined settings.

When the generator is reinitialized, each format in the standard library is tested (one-at-a-time), to determine if the format parameters are fully supported by the generator. This algorithm is necessary because the standard format library is used across all generators. If there are some limitation the generator applies a format justification algorithm. In these cases the generator stores a modified version of the format under a similar name. If the format is beyond what can be corrected the format is left out of the generator's list of formats.

WARNING: The initializing the generator permanently and irreversibly removes all user-created formats, custom images, test sequences and directories from memory.

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To re-initialize generator through system reset:

1. Hold down ACS and DSS while powering up the generator.

   A confirmation message is displayed.

2. Press the Outputs key to continue, or press the Step key to cancel the operation.

To re-initialize and calibrate the generator using command interface:

1. Establish a terminal session with the generator (see page 14).
2. Enter the following command:

   ```
   INIT
   ```

   The generator then goes through a complete self-test and self-calibration procedure.

To re-initialize without calibrating the generator using the command line:

1. Establish a terminal session with the generator (see page 14).
2. Enter the following command:

   ```
   BOIT
   ```

   The generator is re-intialized.

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Calibrating the generator

The 802BT/R generator can calibrate itself. Once calibrated, the generator does not require periodic calibration. There are no physical controls to adjust. All calibration is electronic. Calibration factors are saved in non-volatile memory.

The calibration accuracy of the generator for analog video voltage swing is specified to be ±14mV (or ±2% for a nominal 700mV signal). Using a typical oscilloscope such as a Tektronix VM700T, which might have a swing measurement accuracy of ±14mV, we should expect readings between 674mV to 726mV.

You can also set the analog output calibration factors to values other than those set by the generator's own self-calibration function. Each channel is calibrated using two independent zero calibration points, and two independent slope calibration points. Interpolation equations for the different video types are used to set the caldac values that controls the output sync and voltage levels to the correct values.

Follow the procedures below to calibrate the generator.

To self-calibrate the generator using the front panel:

1. It is not necessary to load the outputs of a generator during self-calibration. However, attaching a nominal load may yield a slight increase in accuracy.
2. Simultaneously depress all three R, G and B video gate keys and power cycle the generator.

   The LCD will display a special message indicating that it is about to do a self-calibration.
3. Release the R, G and B video gate keys and the generator will begin its self-calibration routine.

   You will see calibration factors flash on the display. Observe the display for any error messages that might occur. If an error message appears, make a note of it and call your technical support representative for further assistance.

To self-calibrate the generator using the command interface:

1. Establish a terminal session with the generator. See “Setting up a terminal connection with the generator” on page 14.
2. Enter the following command:

   ```
   SCAL
   ```

   The generator then goes through a complete calibration procedure.

To view analog calibration factors:

1. Enter the following commands to view the analog video Red, Green, Blue calibration factors:

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```
CALF?
```

The generator presents the following in response:

```
1089, 2589, 1993, 3223, 1148, 2633, 2059, 3279, 1000, 2505, 1990,
3219, 793, 787, 3382, 3509
```

Calibrating frequency

All frequencies associated with the generator are derived from a common frequency reference, which can be calibrated using the rate calibration command RATC.

To reduce all frequency errors to zero:

1. Measure any convenient frequency from the generator using a very accurate frequency counter.

   For example, measure the horizontal TTL separate sync frequency with the DMT0660 format loaded and the horizontal rate temporarily set to 100KHz. Enter the following:

   ```
   FMTL DMT0660; HRAT 100E3; ALLU
   ```

2. Measure the TTL horizontal sync frequency with the frequency counter.

3. Divide the frequency that you expect by the frequency that you measure on the frequency counter and enter that ratio using the `RATC` command.

   For example, if you measure 99.9955782499875 kHz, when you expect 100.000000000KHz, then divide 100.000000000KHz by 99.9950002499875kHz and enter the following on the command line:

   ```
   RATC 1.0000442194553987
   ```

   This will raise all frequencies output by the generator and make them exact.

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Cloning generators

This section describes how to copy configuration settings from one generator to other generators using a PCMCIA card. The entire block of battery backed user memory (including video formats, custom test images and test sequences) is copied from one generator to another using a suitable PCMCIA memory card.

The card you need is a Type 1, Battery Backed RAM PCMCIA card with at least 2 MB of storage. These cards are available from synchrotech P/N PCM-SRW-AM002 2MB. Flash or compact type memory cards will not work.

Note: *See VGM online help for procedures for cloning generators using VGM.*

To clone a generator using PCMCIA card:

1. Install the same firmware version on the source and target generators.

   Note: *This procedure can only be used when the firmware of the source and target generators are the same. To verify the firmware version, load the GenStats image.*

2. Insert PCMCIA card into the source generator.
3. Hold down the Step and Outputs keys while starting generator.
4. Choose WR (press Outputs key) to copy the generator configuration to the card.

   The generator displays a *Done* message when it is done writing to the card.

5. Transfer the PCMCIA card to the second generator.
6. Hold down the Step and Output keys while starting generator.
7. Choose RD (press Step key) to copy the configuration data from the card to the generator.

   All user-created objects on the target generator will be deleted. To cancel the operation, press the ACS key.

8. Hold down the ASC, DCS, and DSS keys while starting the generator to return the generator to normal operating mode.

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Installing firmware

Firmware upgrades are available at http://www.quantumdata.com/support/downloads/.

Important: *Always backup any custom objects (formats, images) stored on the generator before installing an upgrade. The firmware installation re-initializes the generator, which deletes any custom objects. After installing the firmware, you can restore custom objects.*

Firmware upgrades require the use of VGM. Please refer to the VGM online help for procedures on upgrading the generator.

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Memory management

The generator includes commands to manage its internal memory resources. These commands or useful if the generator exhibits degraded performance or other anomolies.

To verify and correct memory related anomolies:

1. Check the generator's memory for corruption by running a memory self test:

```
MEMT   // runs the memory self test
MEMT?  // returns the results of the memory self test
1      // returned value from the memory self test
```

   A value of "0" indicates no memory corruption or inconsistency was found. A value of "1" indicates that there is a memory anomoly.

2. If the memory self test reveals a memory corruption, re-initialize the generator:

```
BOIT   // re-initializes the generator
```

3. If the memory self test does not reveal a memory corruption, check to see if there is enough free memory and contiguous memory:

```
MEMF?   // queries for the free memory
808320  // returns the amount of free memory
MEML?   // queries for the largest contiguous block of free memory
816568  // returns the largest contiguous block of free memory
```

   If the amount of memory is low or the amount of contiguous memory is low the memory should be compacted.

4. Compact the generators memory:

```
MEMC    // compacts the memory
MEML?   // queries for the largest contiguous block of free memory
818280  // should show larger block of contiguous free memory
```


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4 Working with Formats

Topics in this chapter:

- Overview
- Format library
- Format naming conventions
- Creating custom formats
- Editing Format knob lists
- Configuring DCS priority scheme
- Creating format aliases

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Overview

The generators enable you to create your own formats and edit the Format knob list through the Video Generator Manager (VGM) application and the command line interface. Please refer to the VGM online help for details on procedures for these functions performed through VGM. This chapter provides procedures for customizing formats through the command line interface.

The following functions are provided:

- **Creating formats.** If the application environment requires constant switching between video outputs, for example, you can build your own library of customized formats that individually select which video output is driven via the proper setting of AVST and DVST parameters.
- **Editing the Format knob list.** You can edit the Format knob list to include any combination of built-in and user-defined formats. The default operating mode of the 802 uses the Format knob to select formats from a list of built in formats.
- **Creating aliases.** You can assign your own names to formats using aliases.

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Format library

The generator has a built-in library of formats. The same format library is used for all 802 models. The formats are stored in read-only memory (ROM) along with the generator's operating code.

Compatibility

Some formats are for displays and graphics systems that may not be compatible with a specific generator model. Attempting to load an incompatible format will give you an error message. If a format has too high of a pixel rate, a modified version of the format can be created with reduced horizontal timing parameters that bring the pixel clock rate below the limit of the generator. The horizontal and vertical rates however are correct. This lets you light-up a display and verify most of its operation. These modified formats can be created through the FMTJ command which references a global parameter (JRAT) that determines the bandwidth of the generator.

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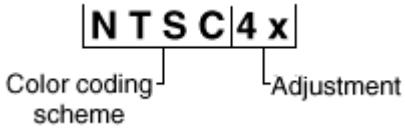
Format naming conventions

The names used in the built-in format library have been updated for the generator. Many format names on previous versions of the 802 generators have been renamed to more closely match the naming conventions used in the display industry or in the appropriate standards. There are three sets of naming conventions described in this section: 1) Composite television formats, 2) Component television formats, and 3) Computer display formats. In addition, several miscellaneous naming conventions are also described.

Composite television format names

Composite television formats apply to RF, D2, CVBS, and S-VIDEO signal interfaces. Composite television format names consist of a three to five character color coding scheme indicator followed by optional characters that indicate format adjustments.

Example



Color coding schemes

- NTSC
- PAL
- SECAM

Adjustments to the format

- 4x == sampling rate is four times the color sub-carrier frequency
- 44 == NTSC with color sub-carrier frequency of 4.43361875 MHz (as opposed to 3.58)
- # == sampling rate is reduced in order to make pixels square
- jp == NTSC-Japan (NTSC without 7.5 IRE setup)
- -M == PAL with 3.57561149 MHz color sub-carrier and M timing (M/PAL Brazil)
- -N == PAL with 3.58205625 MHz color sub-carrier (N/PAL Argentina, Paraguay, Uruguay)
- -N == NTSC color encoding with N timing (NTSC-N)
- -60 == PAL format that allows NTSC tape playback on PAL TV (PAL-60)
- plusKKKK == Enhanced wide-screen PALplus TV transmission system
- p == progressive video game signal (for example, NTSCp or PALp)

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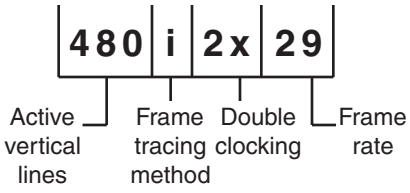
Common composite TV formats with sub-carriers and their respective standards:

- NTSC - ITU-R BT.470-6
- NTSC# - SMPTE 170M
- NTSC#KA - SMPTE 170M
- PAL - ITU-R BT.470-6
- PAL# - ITU-R BT.470-6
- PAL#KA - ITU-R BT.470-6
- SECAM

Component television format names

Component television formats are named by their vertical resolution and scanning method. These formats apply to RGB, YPbPr, YcbCr and HD-SDI video. In component television format naming, the first three or four characters indicate the active vertical lines in the format, the next characters indicate the frame tracing method, and the last two optional characters indicate the frame rate.

Example:



Active vertical lines

- 480 (active lines with 525 total lines)
- 1035 (active lines with 1125 total lines)

Frame tracing methods

- p = progressive
- i = interlaced
- s = segmented frame interlace (e.g. 1080s24, where a 24p frame is segmented into two interlaced fields occurring at twice the frame rate - scene changes only between field pairs – also known as “48sF”)
- x = any – progressive, interlace, or segmented

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Double clocking

- i2x = double-clocked interlace (scene may change between fields) pixels are double-clocked for DVI compatibility)

Frame rate

Frame rate is optional. If no frame rate is given, then the frame rates are assumed.

- 24 = 24 Hz
- 60 = 60 Hz

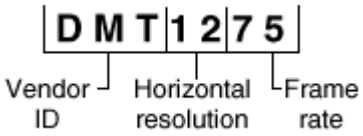
Common component TV formats

- 480pLH Component SDTV signal containing letterboxed 16x9 high-definition content
- 480pSH Component SDTV signal containing anamorphically under-sampled 16x9 content

Computer display format names

Computer display formats are assumed to use progressive scanning. In computer format naming, the first three characters indicate the vendor ID using the EISA ID (for example, IBM, SUN, VSC) or the display type, the next two characters indicate the approximate horizontal resolution, the next two digits indicate the frame rate (which will be half the field rate with interlace scanning), and the final character designates the aperture (used only when the aperture is not A).

Example



Vendor ID (EISA)

- SMT for VESA (digital) Safe Mode Timing
- DMT for VESA Standard Discrete Monitor Timing
- GTF for VESA Generalized Timing Format standard
- CEA for Consumer Electronics Association
- EIA for Electronics Industries Association (CEA)

Approximate horizontal resolution examples

- 02 for 256 pixels
- 09 for 960 pixels

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- 12 for 1200 pixels
- 30 for 3072 pixels

Frame rate examples (half the field rate with interlace scanning)

- 48 for 48Hz
- 60 for 60Hz
- 75 for 75Hz

Aperture (used only when the aperture is not A)

See “Aperture designators” on page 59.

Common computer display formats

- VSC1275 for Viewsonic 1280 by 1024 at 75 Hz
- DMT0685 for Discrete Monitor Timing with 680 by 480 at 85 Hz

Aperture designators

Format names may include one or two characters that describe the aperture of the display. These are listed below.

Aspect ratio

- Q = 1.00:1 Quadrate - MIL, Radiology (square, 512x512, 1024x1024)
- G = 1.25:1 Graphics workstation (5x4, 1280x1024, 1600x1280)
- A = 1.33:1 Academy (4x3, 640x480, 800x600, 1024x768, 1280x960, 1600x1200)
- B = 1.44:1 Big (13x9, IMAX™)
- T = 1.50:1 Three halves (3x2, 1152x768 Apple Computer)
- V = 1.56:1 PALplus WWS case #2 (14x9, see ITU-R BT.1119)
- D = 1.60:1 VESA CVT proposed (16x10, 1728x1080, 1280x800)
- E = 1.67:1 European film (15x9 or 5x3, 1200x720, 1280x768, 1800x1080, a.k.a. “1.66”)
- H = 1.78:1 High-definition image (16x9, 1280x720,1920x1080)
- F = 1.85:1 US film (320x173, 1280x692, 1920x1038)
- U = 2.00:1 Univisum™ (2x1, 1280x640, 1920x960)
- C = 2.39:1 CinemaScope™ (160x67, 1280x536, 1920x804, a.k.a. “2.35”, was 2.35 before 1971)

Content fitting operators

- N = Natural (do nothing)

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- L = Letterbox (linear scale to fit one axis, center w/black bars in other)
- Z = Zoom (blow- up to fill destination aperture with cropping, or LI)
- S = Scope (under-sample content horizontally)
- W = Widescreen (over-sample content horizontally)
- J = Justify (non- linear horizontal expand – more near edges)
- K = Keep safe (shrink to avoid cropping – provide safe title)
- P = Pan & Scan (truncate)
- M = Mirror (horizontally – rear projection)

Other Modifiers

- I = Inverse (undo operator; for example, S = Scope and SI = Inverse Scope)
- O = Orthogonally (rotate operator effect or aperture 90 degrees)
- X = Wildcard or special

Using legacy format names

You can configure the generator to display names using conventions from older generator models.

Important: *Configuring the generator to use legacy names will delete all user-defined video formats currently stored in the generator. Therefore, it is important to back up the user data files from the generator to disk and then restore them back to the generator. VGM can be used to backup the generator.*

To display legacy format names:

1. Turn the generator off.
2. Hold down the **G** key, and then power on the generator.

   The following message appears on the front panel LCD.
3. Release the **G** key. This setting is retained throughout subsequent power cycles.

To re-assert the default format names you must reinitialize the generator:

1. Turn the generator off.
2. Hold down the **ACS** and **DSS** keys and then power on the generator.

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Viewing the format library

You can view the list of formats available in the generator using VGM or the command line interface. Please refer to the VGM online help for instructions on using VGM to view the format list.

To display the format list:

1. Establish a terminal session with the generator.
2. Load the default format directory (fmt) or custom format directory by entering the following command:

   ```
   DIRL fmt
   ```

3. List the contents of the format directory by entering the following command:

   ```
   NAMQ? 1 200 // lists the formats from the first format through 200
   ```

Viewing format details

You can view the format parameters of any standard or custom format using VGM or the command line interface. Please refer to the VGM online help for instructions on using VGM to view format details. Use the following procedure to view the detailed format information through the command line interface.

To view formats parameters using the Format image:

1. Connect the generator with a display.

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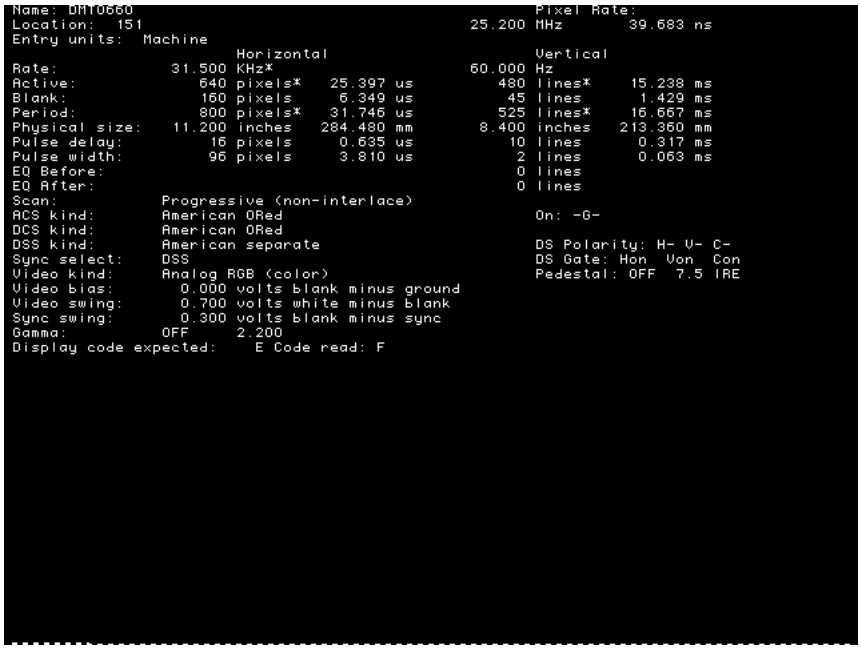
2. Load the Format image.

   Information about the current format is displays.


Name: DM70860
Location: 151
Entry units: Machine
Pixel Rate:
25.200 MHz 39.683 ns
Horizontal
Vertical
Rate: 31.500 KHz* 60.000 Hz
Active: 640 pixels* 25.397 us 480 lines* 15.238 ms
Blank: 160 pixels 6.349 us 45 lines 1.429 ms
Period: 800 pixels* 31.746 us 525 lines* 16.667 ms
Physical size: 11.200 inches 284.480 mm 8.400 inches 213.360 mm
Pulse delay: 16 pixels 0.635 us 10 lines 0.317 ms
Pulse width: 96 pixels 3.810 us 2 lines 0.063 ms
EQ Before: 0 lines
EQ After: 0 lines
Scan: Progressive (non-interlace)
ACS kind: American ORed
On: -G-
DCS kind: American ORed
DSS kind: American separate
DS Polarity: H- V- C-
Sync select: DSS
DS Gate: Hon Von Con
Video kind: Analog RGB (color)
Pedestal: OFF 7.5 IRE
Video bias: 0.000 volts blank minus ground
Video swing: 0.700 volts white minus blank
Sync swing: 0.300 volts blank minus sync
Gamma: OFF 2.200
Display code expected: E Code read: F

3. Press the Step key, then turn Image knob to view additional formats.

To display individual format parameters:

1. Establish a terminal session with the generator.
2. Load the format whose parameters you want to view by entering the following command:

   `FMTL` ***`format;`*** `FMTU //specify a valid format name`

3. Enter the format parameter(s) you want to view. For example, to view the horizontal resolution, vertical resolution, horizontal period, and analog video sync type, enter the following command:

   `HRES? VRES? HTOT? AVST?`

   The generator responds with the information in sequence as shown below:

   `640;480;800;2`

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Creating custom formats

You can create new signal formats for the generator and add them to non-volatile memory. You can create formats through VGM or by using a command line interface (either the RS-232 port or the IEEE-488 port). The recommended procedure for creating new formats is to use VGM. VGM contains the algorithms for ensuring compatibility between format parameters where there are dependencies in their respective values. Please refer to the VGM online help for information about creating formats using VGM.

Determining the signal specifications of the display

Your custom format will be based on the specifications of the display under test. Typically, you can find the information required for the format in the detailed specification sheet for the display. At a basic level, you must determine if you are working with an analog or a digital display. An analog display can show an endless range of colors or shades of gray. Analog displays normally accept video signal levels in the 1 Vp-p range. Digital displays are more limited and can display only a few gray levels or a limited number of pre-defined colors. These displays normally accept TTL video signals in the 4 Vp-p range.

Creating custom formats using the command line interface

There are two methods for creating formats through the command line interface. The first method is to use the FMTN command to set all format parameters in the format buffer to their default values, and then modify each value. The second method is to select an existing format to use as a template for the new format, and then modify only the values needed to create the new format. When using this method, you can save the new format under a new name or the existing name.

Independent of the method you choose, you can enter each command interactively or, using your computer, create a text file containing all the commands you want to issue, and then download the text file to the generator. For instructions on creating and downloading text files, see “Sending commands from text files” on page 16.

Creating a new format

The FMTN command is used in creating a new format. This command sets all of the format parameters to known, default values. For a list of the parameters and their default values, see “FMTN” on page 331. Use the following procedure to create a new format using interactive commands.

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To create a new format:

1. Establish a terminal session with the generator. See “Setting up a terminal connection with the generator” on page 14.
2. Enter the following commands to initialize all parameters to default values and begin a format editing session:

```
FMTN        // initializes all parameters to default values
FMTB        // begins a format editing session
```

3. Enter the format parameter commands in sequence to set the values for the new format.

```
HRES 654    // sets the horizontal resolution to 654 pixels
.
.           // other format parameters
.
HTOT 720    // sets the horizontal total to 720 pixels
```

Note: *You do not need to enter a parameter value if it matches the FMTN default setting.*

4. End the editing session and save the new format using the following commands:

```
FMTE                  // ends a format editing session
FMTA new_fmt_name     // saves format as new specified name
```

5. Assign the format to the knob list using the following commands:

```
DIRL FMT              // loads format directory into edit buffer
DIRB                  // begins a directory edit session
NAMI 20 new_fmt_name  // assigns format to format knob list at 20
DIRE                  // ends a directory editing session
DIRS                  // saves contents of directory as current name
```

Creating a format based on an existing format

Use the following procedure to create a format based on an existing format using interactive commands.

To create a custom format based on an existing format:

1. Determine the signal specifications of the display under test and select an existing format in the generator’s format library whose parameter values are similar.
2. Connect the display to the generator.
3. Using the **Format** knob, select the format you want to use as a template for the new format.
4. Using the **Image** knob, select the Format image to view the parameters of the selected format.
5. Establish a terminal session with the generator.

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6. Enter the following commands to load and begin editing the existing format.

```
FMTL format_name     // loads existing format into the format editor
FMTB                 // begins a format editing session
```

7. Enter the format parameter commands in sequence where the new values differ from the existing format values. For example to modify the horizontal resolution enter the following command:

```
HRES 654
```

Note: *You do not need to enter parameter values if they match the existing format.*

8. End the editing session and save the new format using the following commands:

```
FMTE                 // ends a format editing session
FMTA new_fmt_name    // saves format as new specified name
```

9. Assign the format to the knob list using the following commands:

```
DIRL FMT             // loads format directory into edit buffer
DIRB                 // begins a directory edit session
NAMI 20 new_fmt_name // assigns format to format knob list at 20
DIRE                 // ends a directory editing session
DIRS                 // saves contents of directory as current name
```

Modifying existing formats

The following procedure demonstrates how to modify the parameters of an existing format using the command interface. This example changes an existing digital format from RGB 4:4:4 to YCbCr 4:2:2, and saves the format into the default format directory.

To edit an existing format:

1. Establish a terminal session with the generator.
2. Set the generator to digital friendly mode:

```
SROP 2 (or SROP 2 4)    // sets generator to digital friendly mode
SROP 8                  // sets generator to status display mode
```

3. Load and begin editing the format:

```
FMTL existing_format    // loads existing format into format editor
FMTB                    // begins a format editing session
```

4. Enter the format parameter commands in sequence where the values differ from the default values. For example to modify the component video type enter the following command:

```
DVST 14                 // changes the component color to YCbCr
DVSM 2                  // changes component color make up to 4:2:2
ALLU                    // loads hardware and outputs new signal
```

5. End the editing session and save the format using the following commands:

```
FMTE                    // ends the format editing session
```


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```
FMTA new_fmt_name        // saves format as new specified name
```

6. Assign the format to the knob list using these commands:

```
DIRL FMT               // loads format directory into edit buffer
DIRB                   // begins a directory edit session
NAMI 20 new_fmt_name   // assigns new format to format knob list at 20
DIRE                   // ends a directory editing session
DIRS                   // saves contents of directory as current name
```

7. Load the new format using these commands:

```
FMTL new_fmt_name      // loads new format in edit buffer
FMTU                   // applies new format to the generator
```


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Editing Format knob lists

Stepping through all of the available formats using the Format knob can be time consuming. This is particularly true if you regularly use only a few formats that may be scattered throughout the list. You can set up the 802 to show only the formats you want, in the order you want, when you turn the Format knob. The 802 maintains a list of these formats in non-volatile memory, and you can edit the list to include formats you have created and to remove any unneeded formats. You can edit the Format knob list using the internal editor or the command line interface; however, the most convenient way to edit the list and create custom knob lists is through VGM. Please refer to the VGM online help for instructions on creating and editing format knob lists.

The default Format knob list is named fmt. In addition to editing this list, you can also create new lists and name them to reflect their uses at your site.

Editing format knob list using internal editor

Use the following procedures to edit the format knob list using the internal format editor.

To edit the format knob list:

1. Power-up the generator while holding down the Image key until *programmer* is displayed.
2. Select the FmtList image.

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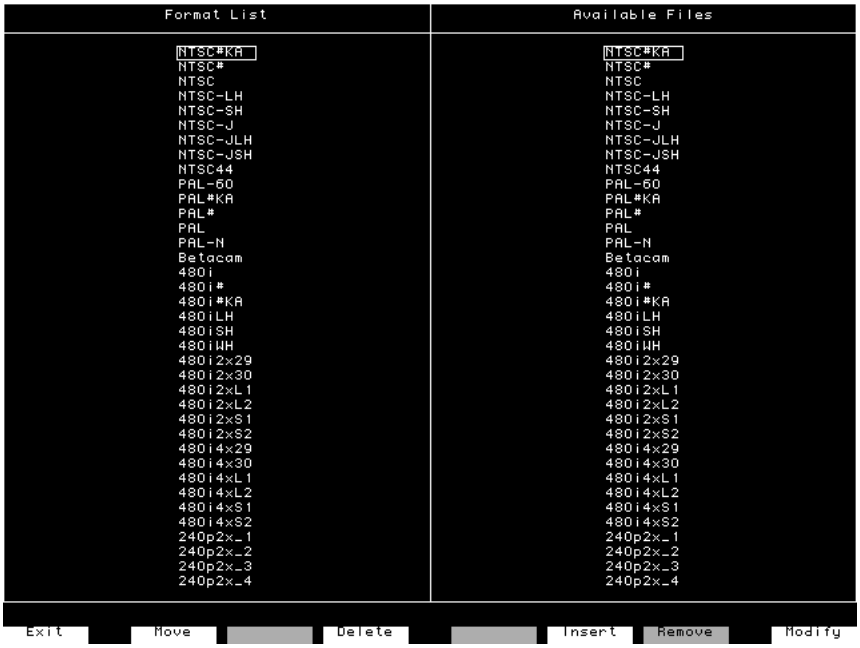
3. Press the Step key to start the Format List editor.



The left side of the screen shows the current contents of the format list. The formats appear in the order that they are selected by the Format knob during normal operation.

The right side of the screen shows the available formats.

4. Use the Format and Image knobs to select formats in the lists. Use these commands to edit the format list.

Key	Function
Insert (DCS)	Inserts the format selected from the list of available files at the cursor position in the format list.
Delete (B)	Remove the selected format from the format list.
Move (R)	Moves the selected format in the format list to another position in the list. To move the selected format, press Move, use the Format knob to specify the target position, and then press the Move key again.
Remove (DSS)	Deletes the format selected in the list of available formats. This will erase the entire contents of the file from non-volatile memory. Since this operation can destroy a lot of programming work, an on-screen message will ask you to confirm the removal of the file. Pressing the Yes or OK key will erase the file. Pressing the No or Cancel key will abort the removal operation.

5. Press the Exit (Step) key to save the edited list and exit the editor.

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Editing format knob list using command line interface

Use the following procedures to edit the format knob list and create new knob lists through the command line interface.

To insert a format at a specific location in a format knob list:

1. Establish a terminal session with the generator.
2. Create a format and save it to the generator (see “Creating custom formats” on page 63.)
3. Enter the following commands:

```
DIRL fmt              // loads default format list (fmt)
DIRB                  // begins a directory editing session
NAMI 257 MyFormat     // inserts format named MyFormat at position 257
DIRE                  // ends the directory editing session
DIRS                  // saves contents of directory as current name
```

To remove a format from a specific location in the format knob list:

```
DIRL fmt              // loads default format list (fmt)
DIRB                  // begins a directory editing session
NAMK MyFormat         // deletes format named MyFormat
DIRE                  // ends the directory editing session
DIRS                  // saves contents of directory as current name
```

To create a new format knob list, enter the following commands:

```
DIRL fmt              // loads default format list (fmt)
DIRB                  // begins a directory editing session
NAMK format_1         // deletes format_1
.
.                      // deletes other formats
.
NAMK format_x          // deletes format_x
NAMI 1 new_format_1    // inserts new_format_1 at location 1
.
.                      // insert other formats
.
NAMI x new_format_x    // inserts new_format_x at location x
DIRE                   // ends the directory editing session
DIRA new_fmt           // saves new format list as new_fmt
```

To apply a new format knob list:

```
FMTP new_fmt          // loads format list new_fmt
```


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Configuring DCS priority scheme

There are two priority schemes for putting composite sync (CS) on the separate VS and HS sync outputs when digital composite sync (DCS) is selected through types SSST = 2, 6, or 11. This applies to both the VS and HS pins of the VGA connector and to the analog component BNC connectors.

- Legacy DSC priority scheme
- Default DSC priority scheme

The following table describes the legacy DCS priority scheme for horizontal sync.

OUTG	SSST	HSPG	VSPG	HS Output	HS Polarity
0	Do not care	Do not care	Do not care	No signal	Do not care
1	Do not care	0	Do not care	No signal	Do not care
Do not care	8 (DPMS – OFF)	Do not care	Do not care	No signal	Do not care
1	9 (DPMS – SUSPEND)	Do not care	Do not care	Horizontal Sync	HSPP
1	10 (DPMS – STANDBY)	Do not care	Do not care	No signal	Do not care
1	1, 3, 5, 7, or 11	1	Do not care	Horizontal Sync	HSPP
1	2, 6, or 11 (DCS)	1	Do not care	Composite Sync	HSPP

The following table describes the legacy DCS priority scheme for vertical sync.

OUTG	SSST	HSPG	VSPG	VS Output	VS Polarity
0	Do not care	Do not care	Do not care	No signal	Do not care
1	Do not care	Do not care	0	No signal	Do not care
Do not care	8 (DPMS – OFF)	Do not care	Do not care	No signal	Do not care
1	9 (DPMS – SUSPEND)	Do not care	Do not care	No signal	Do not care
1	10 (DPMS – STANDBY)	Do not care	Do not care	Vertical Sync	VSPP
1	1, 3, 5, 7, or 11	Do not care	1	Vertical Sync	VSPP
1	2, 6, or 11 (DCS)	1	Do not care	No signal	Do not care
1	2, 6, or 11 (DCS)	0	1	Composite Sync	VSPP

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The following table describe the default DCS priority scheme for horizontal sync.

OUTG	SSST	HSPG	HS Output	HS Polarity
0	Do not care	Do not care	No signal	Do not care
1	Do not care	0	No signal	Do not care
Do not care	8 (DPMS – OFF)	Do not care	No signal	Do not care
1	9 (DPMS – SUS-PEND)	Do not care	Horizontal Sync	HSPP
1	10 (DPMS – STANDBY)	Do not care	No signal	Do not care
1	1, 3, 5, 7, or 11	1	Horizontal Sync	HSPP
1	2, 6, or 11 (DCS)	1	Composite Sync	CSPP

The following table describe the default DCS priority scheme for vertical sync.

OUTG	SSST	VSPG	VS Output	VS Polarity
0	Do not care	Do not care	No signal	Do not care
1	Do not care	0	No signal	Do not care
Do not care	8 (DPMS – OFF)	Do not care	No signal	Do not care
1	9 (DPMS – SUS-PEND)	Do not care	No signal	Do not care
1	10 (DPMS – STANDBY)	Do not care	vertical Sync	VSPP
1	1, 3, 5, 7, or 11	1	vertical Sync	VSPP
1	2, 6, or 11 (DCS)	1	Composite Sync	CSPP

To enable the legacy DCS priority scheme:

1. Turn off the generator.
2. Hold down the **Step** and **DCS** keys while starting the generator.

   The generator will remain in this mode through subsequent power cycles until the generator is re-initialized or reset with the “No special modes” command (hold down ACS+DCS+DSS while starting the generator).

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Creating format aliases

You can create aliases for formats to suit the needs of your site. Use the following procedure to create an alias for a format, save it to the format directory, and then use the alias.

To create and use a format alias:

1. Establish a terminal session with the generator.
2. Enter the following commands:

```
ALIN your_alias format      // assigns alias to format
DIRL FMT                    // loads default format list (fmt)
DIRB                        // begins a format editing session
NAMI 1 "your_alias"         // assigns alias to format directory
DIRE                        // ends a format editing session
DIRA FMT                    // saves alias in default format directory
```

To delete a format alias, enter the following command:

```
ALIK your_alias            // removes the alias
```


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5 Working with Images

Topics in this chapter:

- Overview
- Creating custom images
- Downloading bitmap images from a PCMCIA card
- Looping through images
- Editing Image knob list
- Creating image aliases

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Overview

The 802R/BT includes a library of 250 test images. In addition, you can create custom images, which consist of one or more drawing primitives, including single pixel dots, lines, rectangles, and ovals. You can select the grayscale and color tables used in the image and save the images in non-volatile memory. Custom images can be added to the list of built-in images that can be selected with the Image knob. You can create and edit test images and edit the Image knob list using the Video Generator Manager (VGM) application or the command line interface. Please refer to the VGM online help for details on creating custom images using VGM.

The following functions are provided:

- **Creating images.** You can create your own custom images and add them to the image library.
- **Downloading bitmap images.** You can also create your own images in other applications and save them as bitmap files which can then be downloaded using a terminal emulator or from a PCMCIA card.
- **Editing the Image knob list.** You can edit the Image knob list to include any combination of built-in and custom images. The default operating mode of the 802 uses the Image knob to select images from an internal list of built-in images.
- **Setting up a looping image display.** You can set up a continuous cycling mode that draws images one-after-another in an infinite loop. Image looping can be used for burn-in testing or for running single-mode displays at trade shows.
- **Creating aliases.** You can assign your own names to images using aliases.

Viewing the image list

You can view the list of images available in the generator using VGM or the command line interface. Please refer to the VGM online help for details on viewing the image list using VGM. Use the following procedure to view the image list using the command line interface.

To display the image list:

1. Establish a terminal session with the generator. See “Setting up a terminal connection with the generator” on page 14.
2. Load the default image directory (img) or custom image directory by entering the following command:

   ```
   DIRL IMG
   ```

3. List the contents of the image directory by entering the following command:

   ```
   NAMQ? 1 200    // lists the images from the first through 200
   ```


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Creating custom images

This section describes how to create images and add them to the generator's image library, and how to customize the image list. The recommended method for creating images is create a text file containing the commands for creating the image, and then downloading the text file to the generator. Another method for creating images is to use the Image Editor in VGM to create a basic image, save the basic image as a command file in VGM, and then open and edit the command file to refine the image as needed.

To create custom images with a command file:

1. Using a text editor, open a text file (command file) on your computer and enter the following commands.

```
OUTG 0                  // gates all video and sync outputs off
IMGN new_image          // creates a new image
IMGB                    // begin an image editing session
XRES 640                // sets the horizontal resolution
YRES 480                // sets the vertical resolution
.
.                       // other image parameters
.
IMGE                    // ends an image editing session
IMGA new_image          // saves image as new_image
OUTG 1                  // gates all video and sync outputs on
IMGU                    // draws the image
ALLU                    // applies the buffer to the generator hardware
```

2. Save the text file, using a *.txt extension.
3. Establish a terminal session with the generator. See "Setting up a terminal connection with the generator" on page 14.
4. At the R:> prompt, transfer the text file to the generator. For example, to transfer a file using HyperTerminal, do the following:
   a. On the **Transfer** menu, click **Send Text File**. The **Send Text File** dialog box appears.
   b. Select the text file you want to send, and then click **Open**. HyperTerminal displays the commands as they are sent.
   c. Press **Enter** once to ensure that the last command is sent.
5. Assign the image to Image knob list by entering the following commands:

```
DIRL IMG            // loads image directory into edit buffer
DIRB                // begins a directory editing session
NAMI 20 new_image   // assigns image to image knob list at 20
DIRE                // ends a directory editing session
DIRS                // saves contents of directory as current name
```


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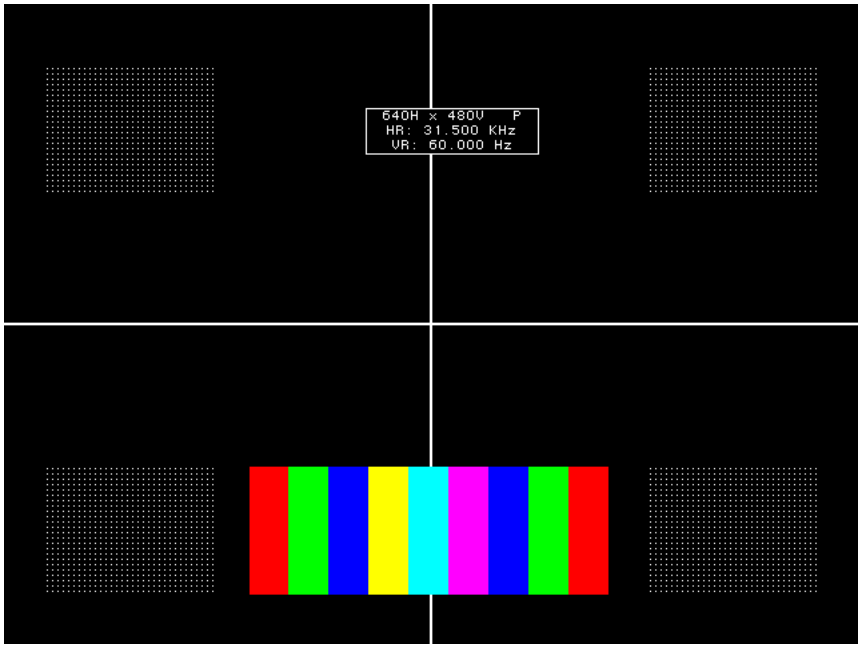
Command file example

The following sample command file creates the image shown in the graphic below.



Commands used to draw image above:

```
IMGN
IMGB                    // begin an editing session
XRES 640                // set the horizontal resolution
YRES 480                // set the vertical resolution
HATO Foreground 24 18
OVAL Foreground  479 479  80 0  GrayPat0
CROS White
RECT White  205 154  770 77  GrayPat50
RECT Black  128 96  30 45  GrayPat100
RECT Black  128 96  482 45  GrayPat100
RECT Black  128 96  30 345  GrayPat100
RECT Black  128 96  482 345  GrayPat100
RECT Red  30 96  184 347  GrayPat100
RECT Blue  30 96  243 347  GrayPat100
RECT Yellow  30 96  273 347  GrayPat100
RECT Cyan  30 96  303 347  GrayPat100
RECT Magenta  30 96  333 347  GrayPat100
RECT Blue  30 96  363 347  GrayPat100
FORM White 271 78
RECT Green  30 96  213 347  GrayPat100
RECT Green  30 96  393 347  GrayPat100
RECT Red  30 96  423 347  GrayPat100
RECT White  128 96  30 45  GrayPat7
RECT White  128 96  482 45  GrayPat7
RECT White  128 96  30 345  GrayPat7
RECT White  128 96  482 345  GrayPat7
```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```
IMGE                    // end an editing session
IMGA MyImage        // save image as MyImage
```


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Downloading bitmap images from a PCMCIA card

This section describes how to store a bitmap image on a standard PCMCIA memory card, and then load the image as you would a built-in image. The generator can load only one image from a card. Although you can download an image using VGM, loading an image from a card is faster and easier.

This feature is supported on 802BT and 802R generators with video board FPGA 91 or later, DVI daughter card FPGA 0xE3 or later, and firmware 7.3834000 or later (802BT) or 7.38180000 or later (802R). To determine your generator specifications, “Displaying system information” on page 44.

To copy an image onto a card:

1. Save the image you want to store on the card as an 8-bit or 32-bit (24-bit TrueColor) bitmap (.bmp) file on your computer using any file name.
2. Hold down the **ACS**, **DCS**, and **DSS** keys, and then cycle the power to the generator. This removes any special modes and sets the baud rate of the serial port to 2400 bps.
3. Establish a terminal session with the generator and change the baud rate of the generator to 38400 bps (see “Changing the baud rate” on page 15.)
4. Insert a PCMCIA card into the slot in the generator.
5. At the R:> prompt, enter the following command to initiate the YMODEM-BATCH file-upload protocol:

   ```
   YMDI
   ```

6. At the R:> prompt, transfer the file to the card. For example, to transfer a file using HyperTerminal, do the following:

   a. On the **Transfer** menu, click **Send File**. The **Send File** dialog box appears.

   b. In the **Filename** box, click **Browse** and select the bitmap file you want to copy to the generator.

   c. In the **Protocol** box, click the down arrow and select **Ymodem**.

   d. Click **Send**.

   Note: You must send the image within about 15 seconds after sending the YMDI command. If the R:> command prompt appears before you send the image, send the YDMI command again, and then send the image again.

   For descriptions of any error codes displayed, see Appendix C, “Error Messages.”

To view an image stored on a PCMCIA card:

1. Insert the card that contains the image you want to view.

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Note: The card you need is a Type 1, Battery Backed RAM PCMCIA card with at least 2 MB of storage. These cards are available from synchrotech P/N PCM-SRW-AM002 2MB. Flash or compact type memory cards will not work.

2. Use one of the following procedures to configure the generator to use a format with the same pixel depth as the image:
   - Select a built-in format with the appropriate pixel depth.
   - Create a format with the appropriate pixel depth.
   - Establish a terminal session with the generator and enter the following commands to set the pixel depth to 32-bit (24-bit TrueColor) or 8-bit:

     ```
     PELD 32; ALLU
     or
     PELD 8; ALLU
     ```

   - Hold down the **R** key while pressing and releasing the **G** key to toggle the pixel depth between 8 and 32-bit pixel depths.
3. Using the **Image** knob, select the CardBMP image, or enter this command:

   ```
   IMGL CardBMP; ALLU
   ```

   The image appears on the display.
4. To view an image from a different card, switch the cards, and then re-select the CardBMP image.

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Looping through images

You can set up a continuous cycling mode that draws all images in the image knob listone-after-another in an infinite loop. When activated, the message “Loop Enabled” appears on the display under test.

To enable image looping:

1. Using the **Format** knob, select a format compatible with the display under test.
2. Turn the **Image** knob clockwise beyond the last image in the Image list about one turn.

   The message “Loop Enabled” appears on the display under test. After a second or two, the first image in the cycle appears and the generator continuously cycles through the test image list using a given format in this mode.

To disable image looping:

1. Turn the Image knob counter-clockwise to stop image looping.

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Editing Image knob list

If your test environment requires only a subset of the available built-in images, you can configure the 802 to show only the images you want, in the order you want, when the Image knob is turned. The 802 maintains a list of these images in non-volatile memory. You can edit this list to include images you have created and to remove unneeded images. The Image knob list can be edited using the command line interface; however, the most convenient way to edit the knob list and create custom knob lists is using VGM. Please refer to the VGM online help for procedures on editing image knob lists.

The default Image knob list is named img. In addition to editing this list, you can also create new lists and name them to reflect their uses at your site.

Editing image knob list using internal editor

Use the following procedures to edit the image knob list using the internal image editor.

To edit list of images:

1. Power-up the generator while holding down the Image key until *programmer* is displayed.
2. Select the ImgList image.
3. Press the Step key to start the image list editor.

   The left side of the screen shows the current contents of the image list. The images are listed in the order that they are selected by the Image knob during normal operation.

   The right side of the screen shows all of the available images. The built-in images are at the top of the list, followed by a factory default custom image. This image is used as starting point to creating you own custom images. Any user-defined images in non-volatile memory are at the bottom of the list.
4. Use the Format and Image knobs to select images in the lists. Use these commands to edit the image list.

Key	Function
Insert (DCS)	Inserts the image selected in the list of available files before the image selected in the image list. The current firmware does not allow entering a secondary version of a built-in image to the list. The primary version will need to be first selected during normal operation. Pressing the Image key will then select the secondary version.
Delete (B)	Remove the selected image from the image list.

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Key	Function
Move (R)	Moves the image selected in the image list to another position in the list. To move the selected image, press Move, use the Format knob to specify the new position, and then press the Move key again.
Remove (DSS)	Deletes the selected user-defined image from the list of available files. This will erase the entire contents of the file from non-volatile memory. Standard images cannot be deleted.

5. Press the Exit (Step) key to save the list and exit the editor.

Editing Image knob list using command line interface

Use the following procedures to edit the Image knob list and create new knob lists through the command line interface.

To insert an image at a specific location in the default image knob list:

1. Establish a terminal session with the generator.
2. Create a custom image and save it to the generator. See “Creating custom images” on page 75.
3. Enter the following commands:

```
DIRL img           // loads default image list called img
DIRB               // begins a directory editing session
NAMI 111 MyImage   // inserts image named MyImage at position 111
DIRE               // ends the directory editing session
DIRS               // saves the contents of directory as current name
```

To remove an image from a specific location in the image knob list:

```
DIRL img           // loads default image list called img
DIRB               // begins a directory editing session
NAMK MyImage       // deletes image named MyImage
DIRE               // ends the directory editing session
DIRS               // saves the contents of directory as current name
```

To create a new image knob list:

```
DIRL img           // loads default image list called img
DIRB               // begins a directory editing session
NAMK image_1       // deletes image named image_1
.
.                  // deletes other images
.
NAMK image_x        // deletes image_x
NAMI 1 new_image_1  // inserts new_image_1 at location 1
.
.                   // inserts other images
.
NAMI x new_image_x  // inserts new_image_x at location x
```


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```
DIRE                // ends the directory editing session
DIRA new_img        // saves new image list as new_img
```

To apply a new image knob list:

```
IMGP new_img        // loads image list new_img
```


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Creating image aliases

You can create image aliases to suit the needs of your site. Use the following procedure to create an alias for an image, save it to the image directory, and then use the image.

To create and use an image alias:

1. Establish a terminal session with the generator.
2. Enter the following commands:

```
ALIN your_alias image       // assigns alias to image
DIRL IMG                    // loads default image list (img)
DIRB                        // begins an image editing session
NAMI 1 "your_alias"         // assigns alias to image directory
DIRE                        // ends an image editing session
DIRA IMG                    // saves alias in default image directory
```

To delete an image alias:

Enter the following command:

```
ALIK your_alias       // removes the alias
```


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6 Working with Test Sequences

Topics in this chapter:

- Overview
- Creating a test sequence
- Viewing the test sequence list
- Running a sequence

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Overview

When testing video displays, you typically select a format using the Format knob, and then select an image using the Image knob. In a production environment, where there might be a need to test several combinations of formats and images, you can create a test sequence to automate the process of selecting formats and images. Test sequences provide a way to progress through a pre-defined sequence of format and images, either manually or automatically.

You can create test sequences using the command line interface, the internal sequence editor or the Video Generator Manager (VGM) application. This section describes how to create and run test sequences using the command line interface and internal sequence editor. Please refer to the VGM online help for instructions on defining and running a test sequence from VGM.

The following functions are provided:

- Create your own custom test sequences consisting of multiple steps. Each step specifies the format and image to display as well as the duration of the step. You can create multiple sequence files, which are stored in non-volatile memory.
- Program the 802R/BT generator to run in test-sequence mode on power-up. This mode of operation is useful in a manufacturing test environment where the same test procedure must be repeated on many identical displays. Multiple test sequences can be stored in the generator and selected by the operator.

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Creating a test sequence

You can create a test sequence using the command line interface, the generator's built-in editor or VGM.

Creating a test sequence using command line

You can develop test sequences either by entering command interactively through a terminal session or by entering a series of commands in a text file and then send them to the generator through hyper terminal. When developing long test sequences, the recommended procedure is to enter commands in a text file, and then send the file to the generator. This approach enables you to change the test sequence without entering the entire command script.

Use the following procedure to create a test sequence, save it to the sequence directory, and then run it using the command line interface.

To create and save a test sequence interactively using the command line interface:

1. Establish a terminal session with the generator.
2. Enter the following commands to create a three-step sequence named *MySeq*.

```
SEQN          // initializes the sequence edit buffer
SEQB          // begins a sequence editing session
STEP 1        // selects a step to be edited
SDLY 5.0      // sets the delay for the current step to five seconds
FMTL 480p59   // loads a format
IMGL SMPTEbar // loads an image
STEP 2        // selects a step to be edited
SDLY 5.0      // sets the delay for the current step to five seconds
FMTL 720p60   // loads a second format (same image)
IMGL Outline1 // loads an image
STEP 3        // selects a step to be edited
SDLY 5.0      // sets the delay for the current step to five seconds
FMTL 1080i29  // loads a third format
IMGL Geom_4   // loads another image
SEQE          // ends the sequence editing session
SEQA MySeq    // saves the current contents of the sequence editor
```

To create and save a test sequence from a text file:

1. Using a text editor, open a text file (command file) on your computer and enter the following commands to create a three-step sequence named *MySeq*.:

```
SEQN          // initializes the sequence edit buffer
SEQB          // begins a sequence editing session
STEP 1        // selects a step to be edited
SDLY 5.0      // sets the delay for the current step to five seconds
FMTL 480p59   // loads a format
```


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```
IMGL SMPTEbar // loads an image
STEP 2        // selects a step to be edited
SDLY 5.0      // sets the delay for the current step to five seconds
FMTL 720p60   // loads a second format (same image)
IMGL Outline1 // loads an image
STEP 3        // selects a step to be edited
SDLY 5.0      // sets the delay for the current step to five seconds
FMTL 1080i29  // loads a third format
IMGL Geom_4   // loads another image
SEQE          // ends the sequence editing session
SEQA MySeq    // saves the current contents of the sequence editor
```

2. Save the text file, using a *.txt extension.
3. Establish a terminal session with the generator.
4. Transfer the text file to the generator. For example, to transfer the file using HyperTerminal, do the following:
   a. On the **Transfer** menu, click **Send Text File**. The **Send Text File** dialog box appears.
   b. Select the text file you want to send, and then click **Open**. HyperTerminal displays the commands as they are sent.
   c. Press **Enter** once to ensure that the last command is sent.

To insert a sequence at a specific location in the sequence list:

1. Establish a terminal session with the generator.
2. Enter the following commands:

```
DIRL seq          // loads sequence directory into edit buffer
DIRB              // begins a directory editing session
NAMI 1 MySeq      // assigns sequence to sequence list at 1
DIRE              // ends the directory editing session
DIRS              // saves contents of directory as current name
```

Creating and editing test sequences using the internal editor

You can use the generator's internal Sequence Editor to create, edit and run test sequences without using VGM. The 802 can be configured to allow an operator to run only certain sequence files in the sequence mode. The 802 maintains a list of these accessible sequences in non-volatile memory. You will need to edit the list if you wish to add sequences you have created. The procedures for creating and editing the sequence file list are provided below.

To create a test sequence using the internal sequence editor:

1. Turn on the generator while pressing the Image key until *programmer* is displayed.
2. Select the SeqList image.

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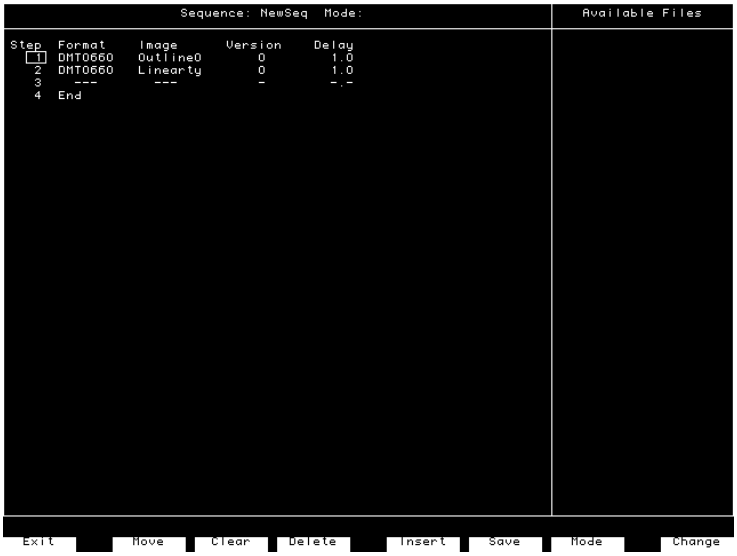
3. Press the Image key to start the Sequence List editor.
4. Use the Image knob to select a sequence file from the list of available files. NewSeq is provided by default to serve as a template.
5. Press the Insert key (DCS) to insert the NewSeq file into the sequence list.
6. Use the Format knob to select the NewSeq file, and then press the Modify key.
7. Use the Format knob to select the field you want to edit. Use the Image knob to select field values.



Press Change (Outputs) to apply the selected value.

Press Insert (ACS) to insert a new step.

Press Clear (G) to delete all steps.

Press Delete (B) to delete the selected step.

To move the selected step, press Move (R), then use the Format knob to select the target position, and then press Move again.

8. Press Mode (DSS) to specify how the generator should run the sequence file when the generator is started. If you have multiple sequence files, the file with the most recent mode setting you make will apply upon startup. Setting the mode for a file will

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deactivate the mode status of all other sequence files. If a start-up mode is not set for any sequence file, then the generator will start in the normal operating mode.

Mode	Display option	Description
blank		If no mode is specified the sequence is not started when the generator is started.
step		Use the Image knob to advance through sequence steps. You cannot advance past the last step. However, rotating the Image knob forward one revolution past the last step will change the mode to automatic. Rotating the Image knob backward one revolution changes the mode back to manual. Step information is displayed on the LCD only.
	step -s#	Current step number is displayed with image on display being tested.
	step -display	Complete step information (sequence name, format, image, and step number) is displayed with image on display being tested.
wrap		Use Image knob to advance through sequence steps. Advancing past the last step restarts at the first step. Step information is displayed on the LCD only.
	wrap -s#	Current step number is displayed with image on display being tested.
	wrap -display	Complete step information is displayed with image on display being tested.
auto		Automatically and continuously cycles though sequence steps, and displays step information on LCD only.
	auto -s#	Current step number is displayed with image on display being tested.
	auto -display	Complete step information is displayed with image on display being tested.

9. Press Save (DCS) to save the sequence file. Use the Format and Image knobs to specify a name for the file by selecting the characters presented.
10. Press Exit (Image) to exit the Sequence Editor, and to return to the Sequence List editor.

To edit the list of sequences that can be used:

1. Hold down the Image key while starting the generator, until *programmer* is displayed.
2. Select the SeqList image.
3. Press the Image key to start the Sequence List editor.

   The Sequence List box shows a list of sequence files that can be selected with the Format knob. The Available Files box shows all sequence files available.

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4. Use these controls to edit the list of sequence files.

Control	Description
Move	Use the Format knob to select the file you want to move, press Move, then use the Format knob to specify the target location, and then press Move again.
Delete	Removes the selected sequence file from the sequence list.
Insert	Inserts the sequence file selected from the list of available files into the sequence list.
Remove	Deletes the sequence file selected in the list of available files from non-volatile memory.
Modify	Opens the selected sequence file in the Sequence Editor.

5. Press Exit to save the list, and to exit the editor.

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Viewing the test sequence list

You can view the list of test sequences stored in the generator using the command line interface, the internal sequence editor or VGM.

Viewing the test sequence list using the command line

Use the following procedure to view the test sequence list using the command line interface.

To view the sequence list using the command line interface:

1. Establish a terminal session with the generator.
2. Load the default test sequence directory (seq) or custom sequence directory using the following command:

   ```
   DIRL seq
   ```

3. List the contents of the sequence directory by entering the following command:

   ```
   NAMQ? 1 4 // lists test sequences from the first through the fourth
   ```

Deleting a test sequence using the command line

Use the following procedure to delete a test sequence list using the command line interface.

To delete a test sequence using the command line interface:

1. Establish a terminal session with the generator.
2. Load the default test sequence directory (seq) or custom sequence directory and begin an editing session using the following commands:

   ```
   DIRL seq
   DIRB
   ```

3. Delete the sequence by entering the following command:

   ```
   NAMK myseq
   ALLU
   ```

4. End and save the sequence editing session using the following command:

   ```
   DIRE
   DIRS
   ```


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Viewing test sequence using internal sequence editor

Use the following procedure to view the test sequence list using the internal sequence editor.

To view the sequence list using the internal sequence editor:

1. Hold down the Image key while starting the generator, until *programmer* is displayed.
2. Select the SeqList image.
3. Press the Image key to start the Sequence List editor.

   The Sequence List box shows a list of sequence files that can be selected with the Format knob. The Available Files box shows all sequence files available.

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Running a sequence

Regardless of how you created a test sequence you can initiate it through the command line, the built-in editor or VGM. For information on running a test sequence through VGM refer to the VGM help. The instructions for running test sequences through the command line or internal sequence editor are provided below.

Running a test sequence using the command line

A sequence can run in one of three modes:

- Step and stop mode, where the progression of the sequence is under user control, and the sequence halts after the final step.
- Step and wrap mode, where the progression of the sequence is under user control, and it continuously loops (repeats the sequence steps).
- Automatic mode, which enables automatic progression through the sequence list and also continuous looping.

The following procedures describe how to use these modes:

To run a sequence in step and stop mode:

1. Establish a terminal session with the generator.
2. Enter the following commands:

```
SEQL MySeq   // loads MySeq into sequence edit buffer
SMOD 1       // sets step mode to manual with stop after last step
SEQU         // starts running the sequence
```

3. Turn the Image knob to progress through the sequence.
4. To stop the sequence, enter the following command:

```
SMOD 0; ALLU
```

To run a sequence in step and wrap mode:

1. Establish a terminal session with the generator.
2. Enter the following commands:

```
SEQL MySeq   // loads MySeq into sequence edit buffer
SMOD 2       // sets step mode to manual with wrapping after last step
SEQU         // starts running the sequence
```

3. Turn the Image knob to progress through the sequence.
4. To stop the sequence, enter the following command:

```
SMOD 0; ALLU
```


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To run a sequence in automatic mode:

1. Establish a terminal session with the generator.
2. Enter the following commands:

```
SEQL MySeq      // loads MySeq into sequence edit buffer
SMOD 3          // sets the sequence mode to run in auto mode
SEQU            // starts running the MySeq sequence
```

3. To stop the sequence, hold down the **ACS**, **DCS**, and **DSS** keys, and then cycle the power to the generator.

To run a sequence at power up:

1. Run the sequence in the desired mode.
2. Turn off the power to the generator.
3. Start the generator in normal operating mode (without holding down any keys).
4. Depending on the selected mode, the sequence will start automatically, or you can turn the Image knob to move forward and backward though the sequence.

   The format and image names for each step and the current step number will appear on the LCD. Additional status information may appear before the step number, depending on the mode. This will be S for step, W for wrap and A for automatic.

```
<format><seqName>
<image> <seqStep>
```

5. To stop the sequence, hold down the **ACS**, **DCS**, and **DSS** keys, and then cycle the power to the generator.

To run a manual sequence continuously:

1. Rotate the **Image** knob a full turn clockwise beyond the last step. A message on the LCD will confirm that the continuous cycle is running.
2. To stop the cycle, rotate the Image knob counter-clockwise. The generator will remember if the sequence was in continuous cycle mode on power down. If so, it will remain in continuous cycle mode when the generator is powered on.

Running a test sequence using internal sequence editor

To run a sequence, that was created using the internal sequence editor:

1. Configure one sequence file with a mode setting through the sequence editor (see “Creating and editing test sequences using the internal editor” on page 88).
2. Start the generator in normal operating mode, without holding any keys down.

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3. Depending on the mode of the sequence, the sequence will start automatically, or you need to turn the Image knob to move forward and backward though the sequence.

   The LCD will display the format and image name for each step, and the current step number. Additional status information may appear before the step number, depending on the mode (manual, automatic, wrap).

   A manual mode sequence can be set to continuously cycle through all the steps, by rotating the bottom knob a full turn clockwise beyond the last step. A message on the LCD will confirm that the continuous cycle is running. The cycle is stopped by rotating the bottom knob counter-clockwise. The generator will remember if the sequence was in continuous cycle on power down. If so, it will continuous cycle on power on.

   If multiple sequences have been defined, use the Format knob to load other sequences.

   Note: *When controlling the generator from a program, it is possible to make any sequence the "Power-on" sequence without having it appear on the sequence knob directory. In this case, the generator will power-up in the sequence mode with the selected sequence, but loading a different sequence file with the Format knob, will not allow you to get back to the original power-up sequence file.*

Cancelling the start-up sequence mode

If the generator has been configured to run a sequence at start-up, and you want the generator to start in normal operating mode, you need to power the generator up while indicating "no special modes" (press and hold the ACS, DCS and DSS keys).

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7 Using GPIB Interface

Topics in this chapter:

- Overview
- Setting the GPIB port address
- Queries and commands
- Status queries and control

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Overview

You can operate and program the 802 generator from an external computer or terminal using either the RS-232C serial port or optional IEEE-488 (GPIB) port. The GPIB port enables the 802 to be used as a programmable video signal source for integration into automated test systems that use IEEE-488 or GPIB communications between instruments.

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Setting the GPIB port address

The default GPIB address is 15. You can specify a different address.

To set the address of the GPIB port directly on the generator:

1. Locate the rotary switches on the back of the generator between the RS-232 port and the GPIB port. These are accessible through the ventilation slots. There are two rotary switches: the one on the left configures the value of the tens digit and the one on the right configures the value of the ones digit.

2. Set the rotary switches first the value of the tens switch and then the value of the ones switch to the desired value.

3. Hold down the **DCS** key, and then cycle the power to the generator. The port is set to the new address.

   Note: *A normal power cycle will not update the memory to the new switch settings.*

To set the address of the GPIB port using the command line:

1. Establish a terminal session with the generator

2. (Optional) Enter the following command to check the current address:

   ```
   GPIB?
   ```

3. Enter the following command:

   ```
   GPIB address
   ```

   When the address is changed with the GPIB command, the change takes place as soon at the command is issued.

   The new address setting will be maintained until 1) the address is changed with another GPIB command, 2) the unit is re-initialized with an INIT command, or 3) the unit is re-initialized because the power-up self test found corrupted data in battery-backed system memory. In cases 2 and 3, the GPIB address will revert to the address set on the GPIB address switches if the unit has them, or to 15 if the unit does not have GPIB address switches.

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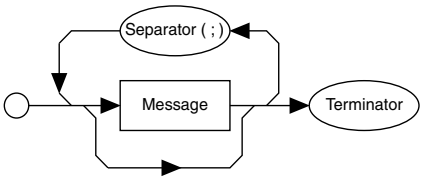
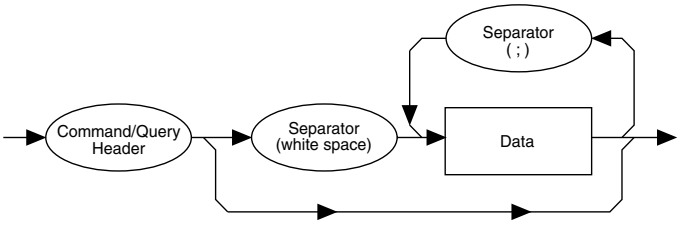
Queries and commands

The GPIB interface is an ASCII command line interface like the RS-232 command line interface. The communications protocol is per IEEE-488.2 specification. Queries and commands consist of four ASCII upper/lower case characters. Commands do not require a response from the generator, while queries cause the 802 to respond with the required data.

You can send multiple commands on the same line by separating the commands with a semicolon (;) followed by a terminator. A terminator is defined as the NL character (ASCII 10), or EOI sent with the last byte of the command. The 802 will not parse any commands received until a terminator is received. All commands are executed sequentially; that is, when a command is parsed it is allowed to finish execution before the next command is parsed, as illustrated in the following figure.



Program Message Syntax



Message Unit Syntax

Commands

Commands instruct the 802 to set a parameter to the value given or perform some function not requiring any additional data. Commands which have an asterisk (*) as their first character are common commands as defined by the IEEE-488.2 standard and generally operate the same in all instruments. All commands are listed and described in Appendix A, “Command Reference.”

Commands which do not require any additional data from the controller are self-contained and should be followed by either a message separator (;) or message terminator. Any other characters (except whitespace characters) will cause a command error.

Commands which require numeric data must be followed by at least one separator character (whitespace), and then the data. Numeric data sent with a command is in decimal format. Numeric data can be represented in one of three methods: integer, floating point, or scaled floating point.

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For example, the following number can be represented in three ways:

- Integer (42)
- Floating point (42.00)
- Scaled floating point (4.200E+01)

Queries

Queries are comprised of a header followed immediately by a question mark (?). If there are any characters between the query header and the question mark character (including whitespace), a command error will result. Queries, return a response message upon completion of execution. A response message is comprised of the requested data terminated with an NL (ASCII 10) character. For example the following text would be returned in response to the HRAT? (horizontal rate query) message:

```
3.1500E+04<NL>
```

Note that the HRAT? query returns its parameter in exponential form. Possible returned parameter forms are:

- Integer (3965)
- Exponential (+3.965E+03)
- String ("text string")

Output queue

When a query is executed, the resulting response message is placed in an output queue where it can be read by the controller. The 802 has an output queue that is 255 bytes long. When a message is present in the output buffer, the MAV (message available) bit in the Status Byte register is set. This varies slightly from the 488.2 standard in that the MAV bit will be set only when at least one complete response message is present in the output queue. A complete response message consists of response message text and a message terminator (NL).

Buffer deadlock

Buffer deadlock occurs when the 802 tries to put a response message in the output queue when the output queue is full and the controller is held off while sending a new message because the input buffer is full. If deadlock occurs, the 802 will clear its output queue, set the query error (QYE) bit in the Event Status register and proceed to parse incoming messages. If any additional queries are requested while in deadlock, those response messages will be discarded.

The 802 will clear the buffer deadlock when it finishes parsing the current command/query. The QYE bit will remain set until read with the *ESR? query or cleared with the *CLS command.

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Sending commands and queries

The generator parses command lines one at a time. Command lines must be terminated with a carriage return (<cr>).The generator immediately echoes each character as it is received and places it in a command line buffer. This buffer currently has room for a total of 256 characters. If more than 256 characters are sent before sending a <cr>, then the following response will be given:

```
Buffer overflow<cr><lf><cr><lf>R:\>
```

Upon receiving a carriage return, the generator immediately echoes the <cr> and follows it with a line feed (<lf>). The generator then parses the command line and initiates whatever processing is implied. The generator then responds with one of the following four responses depending on the condition:

```
Command invalid<cr><lf><cr><lf>R:\>

<message1><cr><lf><message2><cr><lf>...<messageN><cr><lf><cr><lf>R:\>

Execution error: <nnnn><cr><lf><cr><lf>R:\>

R:\>
```

Where <cr> and <lf> are the carriage return and line feed characters, respectively.

Note: *Handshaking routines should only look for > and not R:\>. In the future, the R:\ part of the prompt may change (for example, may be expanded to indicate the current path).*

Bench-top generators output the following prompt on their serial port after finishing the power-on procedure.

```
R:\>
```

This feature allows ATE systems to know when the generator is ready.

Sending multiple commands and queries per line

You cans send multiple commands and queries per line by separating each command or query with a semi-colon (;) character. For example:

```
HTOT 900; ALLU
```

The response to multiple queries will be a series of data elements separated by semi-colons (;). For example, with the VGA_m3 format loaded, the following command string will produce the response shown.

```
HRES?; VRES?; VTOT?
640;480;525
```

Normally, all of the commands on a command line associated with a single command terminator are read as a single command message without regard for execution or completion order. However, by inserting the *WAI command, you can force the generator

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to wait for all preceding commands to be completed before the commands that follow *WAI are processed. For example, sending the following command line causes a red rectangle to be drawn and then overwritten by the colorbar image.

```
IMGL COLORBAR; IMGU; IMGE; RECT RED 200 200 0 0 GRAYPAT100
```

Note that the IMGU command merely requests that the current image be rendered eventually, not necessarily right away nor in a single attempt. By inserting a *WAI command after the IMGU, the generator is instructed to render the colorbar image first, before rendering the red rectangle. This command ensures that the generator draws the red rectangle on top of the colorbar image.

```
IMGL COLORBAR; IMGU; *WAI; IMGE; RECT RED 200 200 0 0 GRAYPAT100
```

The generator will wait until the colorbar image has been completely rendered before it reads and executes the RECT command.

The *WAI command is required by the IEEE-488.2-1992 standard, but also works with GPIB and RS-232 protocols as well.

Completion handshake

The generator returns a > prompt immediately after an FMTU, IMGU, ALLU, BOOT, INIT, or SCAL command is received, even if these commands have not finished executing. If the system controlling the generator must know when the process started by one of these commands has been completed, then append *OPC? to the command string.

For example, the following command causes the generator to wait until all processes have been completed before responding with the number 1 and sending the > prompt.

```
FMTL VGA_M3; IMGL FLAT; ALLU; *OPC?
```

The *OPC? command is required by the IEEE-488.2-1992 standard, but also works with GPIB and RS-232 protocols as well.

Input buffer

Since some commands may take longer to execute, the 802 has an input buffer. This input buffer is 255 characters long and can be written to by the host controller while the 802 is busy executing or parsing previous messages. If the input buffer becomes full, the 802 will hold off the controller until there is room in the buffer. For this reason, a program message cannot be longer than 255 characters including terminator.

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Status queries and control

To create applications that control the generator using the GPIB port, it is sometimes necessary to query the status of the generator and set or reset the status bits and bytes. There are two sets of status registers: 1) the Event Status Register and Event Status Enable Register and 2) the Status Byte Register and Service Request Enable Register. These are described in the following paragraphs.

Status byte

The status byte used by the 802 is the same as that defined by the IEEE-488.2 standard and does not use any other bits of the status byte. The status byte is one part of a complete status reporting system shown in the figure on page 105. The status byte is read by using the serial poll feature of your controller.

Requesting service

The GPIB provides a method for any device to interrupt the controller-in-charge and request servicing of a condition. This service request function is handled with the status byte. When the RQS bit of the status byte is true, the 802 is requesting service from the controller. There are many conditions which may cause the 802 to request service. For more information about these conditions, see the *SRE command description (page 212). The table below lists the status commands and queries.

Status commands and queries	Definition
*ESE	Sets the Event Status Enable register to the given mask value. When a bit in the Event Status register goes high and the corresponding bit in the Event Status Enable register is a 1, it is enabled and will cause the ESB bit in the Status Byte register to go high.
*ESE?	Returns the current value of the Event Status register. After this command is executed, the Event Status register is cleared. This is the only way of clearing any bit in the Event Status register except by the *CLS command.
*SRE	Sets the Service Request Enable register to the mask value given. When a bit in the Status Byte register goes true and the corresponding bit in the Service Request Enable register is also true, the 802 will request service using the GPIB.
*SRE?	Returns the current value of the Service Request Enable register.
*STB?	Returns the current value of the Status Byte register. The value stored in the Status Byte register is not affected by reading it.
*CLS	Clears the Event Status register, the Status Byte and the output buffer.

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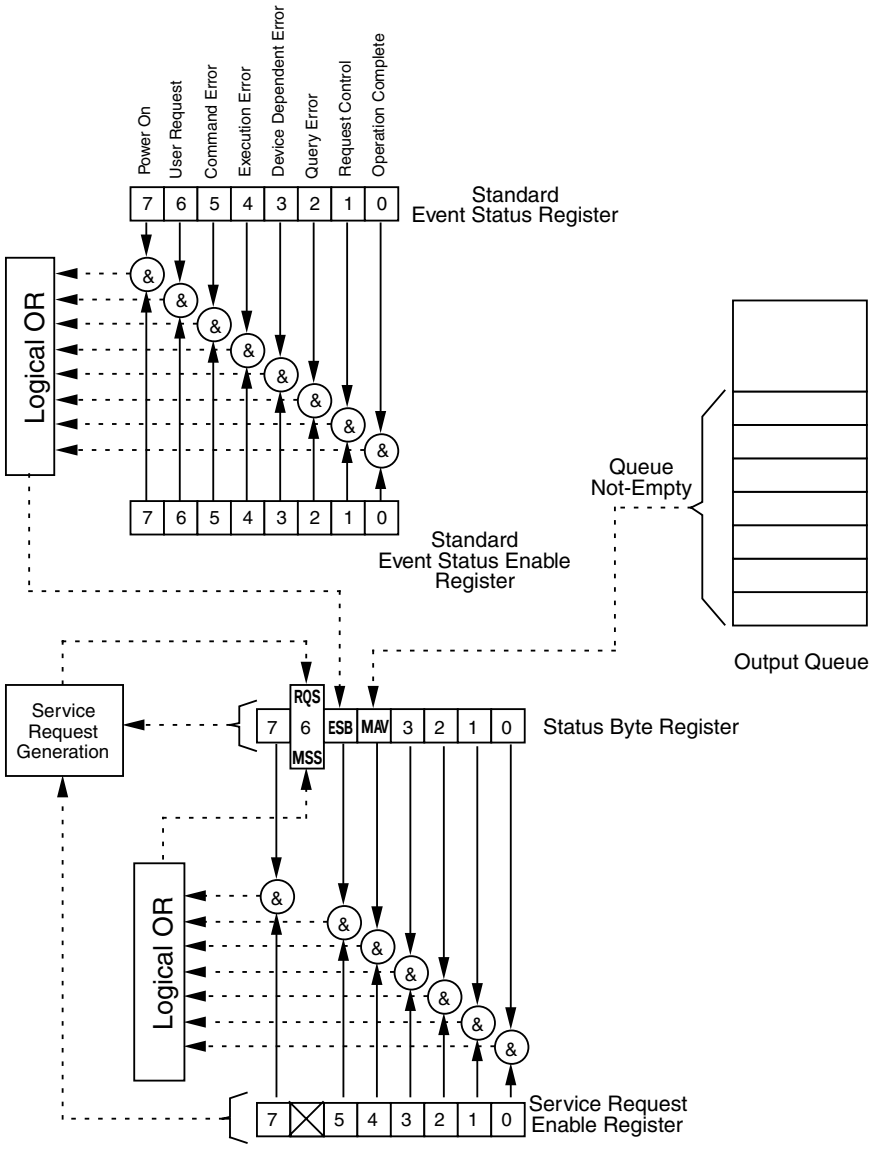
The following figure illustrates IEEE-488 status reporting.



Status byte bit	Definition
MAV	Message available. Indicates that at least one complete response is present in the output buffer.
ESB	Event status bit. Indicates that one of the enabled conditions in the Standard Event Status register is set.
MSS	Master summary status. Indicates that the 802 has a reason for requesting service.
RQS	Request service. This bit is read only by executing a serial poll of the 802.

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Event Status bit	Definition
OPC	Operation complete. Indicates that all operations have been completed.
RQC	Request control. Indicates that a device is requesting control. The generator will never request control, so this bit will always be 0.
QYE	Query error. Indicates that a query request was made while the generator was in deadlock.
DDE	Device dependent error. Indicates that the generator encountered an error executing a command.
EXE	Execution error. Indicates that there was an error parsing a parameter.
CME	Command error. Indicates that there was an unrecognizable command.
URQ	User request. Indicates that a front panel key has been pressed or that the front panel knob has been turned.
PON	Power on. Indicates that power has been turned off and on. This bit will always be 0 in the generator.

Bus commands

The IEEE-488.1 standard defines bus commands, which are sent to the 802 with ATN true. The following table lists bus commands supported by the generator. For more detailed descriptions of these commands, see the IEEE-488.1 and 488.2 standards.

Command	Description
DCL	Device clear. Clears the input buffer and output queue, and stops parsing any commands.
SDC	Selected device clear. Same as DCL.
GTL	Go to local. Enters the local state. See “Remote/local operation” on page 106.
LLO	Local lockout. Enters the lockout state. See “Remote/local operation” on page 106.
SPE	Serial poll enable. Enables transmission of the Status Byte.
SPD	Serial poll disable. Exits the serial poll state.

Remote/local operation

The 802 has complete remote/local operation as defined by the IEEE-488.1 standard. All four remote/local states (REMS, LOCS, RWLS and LWLS) are supported.

In the remote state (REMS), the 802 is under remote control and messages are processed as received. The generator enters the remote with lockout state (RWLS) if the controller issues the local lockout (LLO) message to the 802. The generator enters the local state (LOCS) when the REN line goes false or the controller issues the go to local (GTL) message to the generator, or a front panel control is actuated.

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In the remote with lockout state (RWLS), the generator is under complete remote control and front panel controls are disabled. The generator enters the RWLS state when the controller issues the local lockout (LLO) message to the generator. Front panel access is re-enabled when the controller issues the go to local (GTL) message to the generator.

In the local state (LOCS), the generator is under local control and all front panel controls are enabled. Any remote messages received are stored for processing when the generator enters the remote state again. The generator enters the remote state (REMS) if the REN line is true and the generator is addressed to listen.

In the local with lockout state (LWLS), the generator is under local control, and all front panel controls are enabled. Any remote messages received are stored for processing when the generator enters the remote state again. The generator enters the remote with lockout state (RWLS) if it is addressed to listen.

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8 Analyzing Digital Sources and Cables

Topics in this chapter:

- Getting started
- Measuring timing of video signal
- Testing cables and distribution systems
- Measuring pixel errors
- Testing InfoFrames (HDMI only)
- Testing audio (HDMI only)
- Controlling analyzer using command-line interface
- Generating pseudo-random noise from your device

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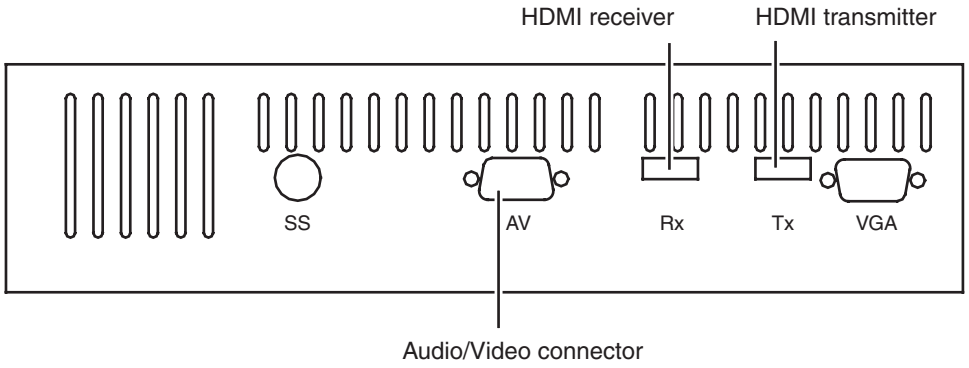
Getting started

The HDMI and DVI Analyzer options provide the 802 video test generator with the ability to test and verify the quality of an HDMI or DVI video signal, respectively. Having both a transmitter and receiver, the 802 generator with the Analyzer feature can be used to:

- **View timing of an HDMI/DVI video signal**. Connect an HDMI/DVI source to the HDMI/DVI Rx connector to measure and analyze the timing parameters of the signal.
- **Generate pseudo-random noise test pattern.** Connect an HDMI/DVI host to the HDMI/DVI Tx connector to receive pseudo-random noise for testing purposes.
- **Analyze pixel data at different frequencies**. Examine the quality of HDMI/DVI pixel transmission (including source, cables and distribution systems) for data errors and flickering pixels.
- **View InfoFrame packets from an HDMI signal.** Display and validate InfoFrame packets transmitted from an HDMI source

This chapter provides procedures for testing with the analyzer through the front panel and through the command line. Front panel instructions are provided initially for each test. For procedures using the command line refer to “Controlling analyzer using command-line interface” on page 130.

HDMI analyzer connections



Monitoring HDMI analyzer signal input

With the HDMI analyzer option, you can externally monitor the video and/or audio content of an incoming HDMI signal. This feature lets you view and hear HDMI content that is received at the HDMI Rx connector while analysis and testing functions are performed by the analyzer.

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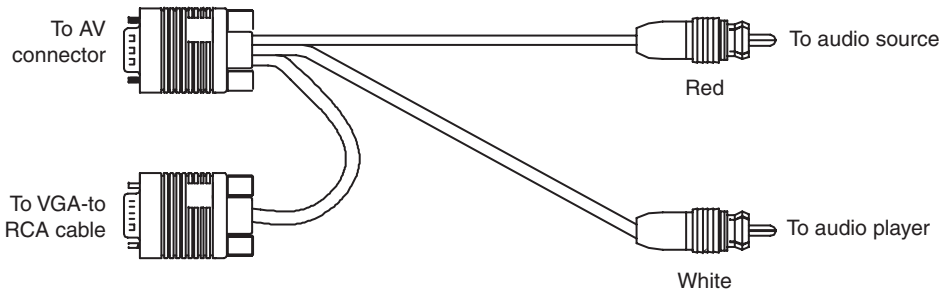
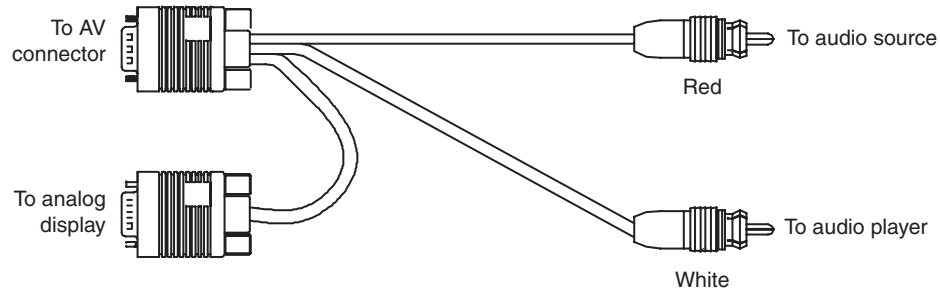
To monitor HDMI input:

- Use the VGA-to-RCA cable (part 30-00148) to connect the AV connector with a YPbPr display, and the audio connections, as shown below.



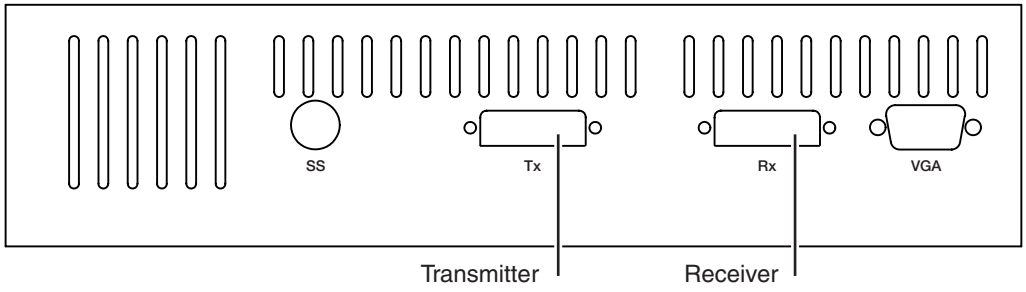
A VGA-to-RCA (3) cable is available from Quantum Data (part 99-00503), which requires a female-to-female HD15 adapter, which is also available from Quantum Data (part 09-00251).

- Use the VGA-to-RCA cable (part 30-00148) to connect the AV connector with an analog VGA display, and the audio connections as shown below.



DVI analyzer connections

The 802 generator with the DVI analyzer option is equipped with two digital DVI connectors. In addition to a DVI Tx (output) connector that emulates a DVI transmit device, a DVI Rx (input) connector is provided that allows a high-quality DVI display to be emulated.



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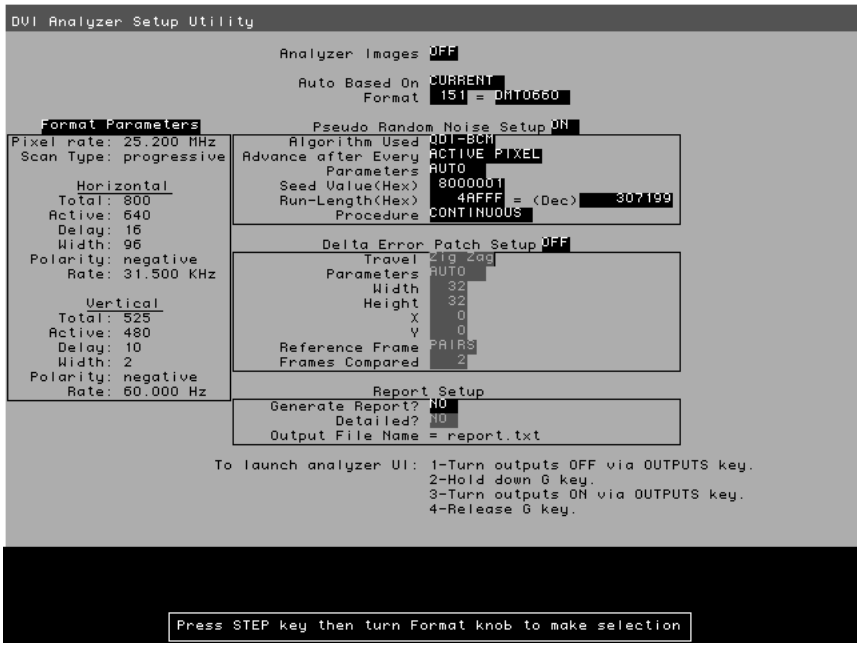
Starting the Analyzer Setup Utility

Use the Analyzer Setup Utility to view or modify the configuration of the analyzer.

To start the Analyzer Setup Utility:

1. Start the generator in Digital-Friendly mode (see page 18).
2. Connect a digital display with the DVI or HDMI transmitter on the generator.
3. Select a format supported by the display (see "Selecting formats automatically" on page 25).
4. Select the Analzyer image.

   The Analyzer Setup Utility appears on the connected display.



Note: *The Report Setup feature is not implemented.*

Enabling and disabling analyzer images

Certain analyzer tasks require images to be displayed on an HDMI/DVI display.

To enable or disable display of analyzer images:

1. Start the Analyzer Setup Utility (see page 112).
2. Press and release the **Step** key.

   The **Step** key illuminates and the **Analyzer Images** field is highlighted.

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3. Using the **Image** knob, toggle between ON (to enable analyzer images) and OFF (to disable analyzer images) setting.
4. Press and release the **Step** key to save the currently displayed parameters.

   The light on the **Step** key extinguishes, and the new settings are implemented for Analyzer mode operation.

Starting the analyzer

The analyzer functions as a special operating mode within the 802 generator. You must place the generator into this mode to perform any analyzer tasks.

To put the generator in the analyzer mode:

1. Start the generator in Digital-Friendly mode (see page 18).
2. Press and release the Outputs key. The light on the key extinguishes.
3. While holding down the G key, press and release the Outputs key.

   The Outputs key illuminates and the following message appears on the LCD. This indicates that the generator is in analyzer mode (example shows DVI analyzer).

To take the generator out of the analyzer mode:

1. Press and release the Outputs key.

   The generator is returned to the normal mode as a signal source. The LCD shows the format and image currently active.

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Measuring timing of video signal

The analyzer provides the ability to analyze signal timing information of an external HDMI/DVI source device. This feature allows you to test a transmitted HDMI/DVI signal for anomalies and verify that the proper timing is output by the HDMI/DVI transmitter for a given signal format.

The procedures below provide instructions for configuring the analyzer through the front panel. Note that you can also measure timing with the analyzer through the command line. For procedures using the command line refer to “Signal timing analysis commands” on page 130.

The analyzer provides two measurement methods:

- **Basic timing measurement** – Displays limited measurements on LCD.
- **Detailed timing measurement** – Displays detailed measurements on a display connected with the generator.

The procedures below provide instructions for configuring the analyzer through the front panel. Note that you can also measure timing with the analyzer through the command line. For procedures using the command line refer to “Signal timing analysis commands” on page 130.

Setting up analyzer to measure timing

To operate the analyzer, you must select the desired HDMI/DVI signal source and set signal format settings and parameters.

To set HDMI/DVI signal source parameters:

1. Start the Analyzer Setup Utility (see page 112).
2. Press and release the **Step** key.

   The **Step** key illuminates and the **Analyzer Images** field is highlighted.
3. Using the **Format** knob, select the **Auto Based On** field.
4. If using the HDMI/DVI signal originating *internally* from the generator, follow these steps:

   a. Using the **Image** knob, select CURRENT in the highlighted field.

   b. Using the **Format** knob, select the **Format** field.

   c. Select the desired signal format number using the cursor (displayed under a digit in the field) as follows:

      - To move the cursor between digits, press the **R** and **G** keys.

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- To select a number for a digit, turn the **Image** knob.

As the number in the **Format** field changes, the appropriate timing parameters for the selection appear in the box under the **Format Parameters** field.

5. If using an HDMI/DVI signal originating *externally* from the generator, follow these steps:

   a. Select MEASURED in the highlighted field.

   b. Select the **Format Parameters** field using the **Format** knob.

   c. Capture the external signal's timing parameters by pressing and releasing the **B** key.

   d. Configure the HDMI/DVI transmit device to output an HDMI/DVI signal.

   After a few seconds, the external signal's timing parameters are displayed in the box under **Format Parameters** and in the **Run Length(Hex)** field.

   Important: *If the external source signal's timing parameters change (or the field selection is changed), the signal timing parameters must be recaptured.*

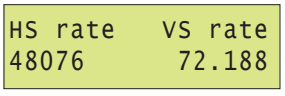
6. Press and release the **Step** key to save the currently displayed parameters.

   The light on the **Step** key extinguishes, and the new settings are implemented for analyzer mode operation.

Measuring basic timing parameters

To view basic timing information of an external HDMI/DVI source signal:

1. Connect the HDMI/DVI transmit device to the HDMI/DVI Rx connector on the generator.
2. If necessary, set the proper HDMI/DVI signal source parameters within the generator.
   - See "Starting the Analyzer Setup Utility" on page 112 for steps on viewing the current analyzer configuration.
   - To edit HDMI/DVI signal source parameters, see "Setting up analyzer to measure timing" on page 114.
3. If desired, monitor the video signal received on the HDMI Rx connector (see page 110).
4. Start the analyzer (see "Starting the analyzer" on page 113).
5. Press and release the **R** key to display the horizontal and vertical frequencies of the HDMI/DVI signal on the LCD (see example below).



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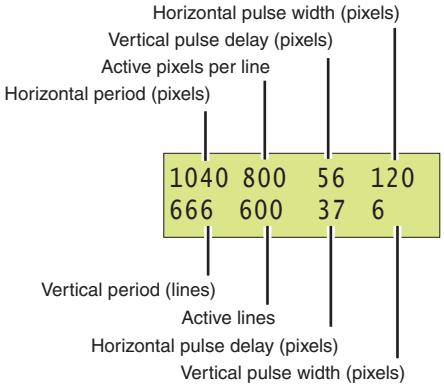
6. Press the G key to display the following format parameters on the LCD.



Measuring detailed timing parameters

The analyzer can analyze detailed HDMI/DVI signal timing information. The timing information is displayed on an HDMI/DVI display connected to the generator.

To view detailed timing information of an external HDMI/DVI source signal:

1. Connect the HDMI/DVI transmit device to the HDMI/DVI Rx connector on the generator.
2. Connect an HDMI/DVI display to the HDMI/DVI Tx connector on the generator.
3. If necessary, set the proper HDMI/DVI signal source parameters within the generator.
   - See “Starting the Analyzer Setup Utility” on page 112 for steps on viewing the current analyzer configuration.
   - To edit HDMI/DVI signal source parameters, see “Setting up analyzer to measure timing” on page 114.
4. If desired, monitor the video signal received on the HDMI Rx connector (see page 110).
5. Using the **Format** knob, select an appropriate format for the connected HDMI/DVI display.

   Note: *To automatically configure the Format knob list based on the EDID structure of a DDC-compliant display, hold down the* **R** *key, then press and release the* **ACS** *key.*

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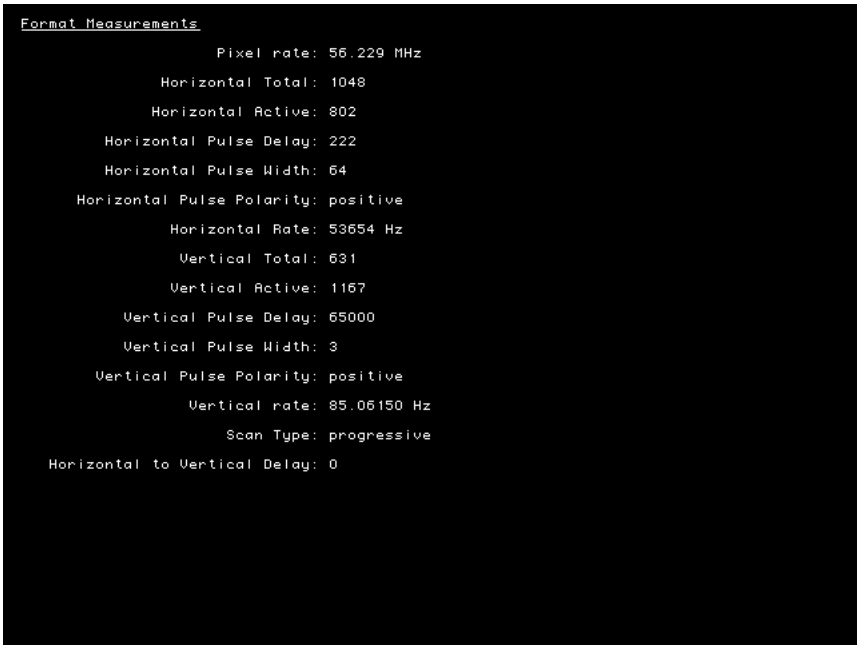
6. Using the **Image** knob, select the FormatRx image.

   Detailed timing information of the HDMI/DVI signal is displayed on the HDMI/DVI display (as shown in the example below).



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Testing cables and distribution systems

This section describes how to test HDMI or DVI cables, and distribution systems using pseudo-random noise. Using different signal formats, the HDMI/DVI cable can be tested over a wide range of frequencies.

The procedures below provide instructions for testing cable and distribution systems with the analyzer through the front panel. Note that you can also perform these procedures through the command line. For procedures using the command line refer to “Analyzing pseudo-random noise in a cable or distribution system” on page 133.

To test a cable or distribution system:

1. Connect the HDMI/DVI cable to be tested between the HDMI/DVI Tx and Rx connectors on the generator.

   Note: *If you are testing a fiber optic cable, plug the fiber optic cable connector marked “transmitter” to the HDMI/DVI Tx connector on the generator, and plug the connector marked “receiver” to the HDMI/DVI Rx connector on the generator. Use a 5 Vdc power supply adapter at the receiver side of the cable.*

2. If necessary, set the proper HDMI/DVI signal source and pseudo-random noise parameters within the generator.

   - See “Starting the Analyzer Setup Utility” on page 112 for steps on viewing the current analyzer configuration.
   - You will have to configure the analyzer for an internal source. To edit HDMI/DVI signal source parameters, see “Setting up analyzer to measure timing” on page 114.

   Note: *The HDMI/DVI signal source must be set to internal (***Auto Based On** *field set to* CURRENT*) for this procedure.*

   - For information on what values to set the pseudo-random noise parameters as well as instructions on how to set them, see “Setting pseudo-random noise parameters” on page 142.

3. (HDMI only) If desired, monitor the video signal received on the HDMI Rx connector (see “Monitoring HDMI analyzer signal input” on page 110).

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4. Using the **Format** knob, select the signal format you want to use.

   Any built-in formats may be used for this test. However, we recommend using several formats spread over a wide range of frequencies. For example, the Test165 format is commonly used to test at the maximum pixel frequency (165 MHz), while the DMT0660 format can be used to test at a very low frequency (25.175 MHz).Use the following formats to test single-link DVI over a range of frequencies:

Format	Pixel rate (Mhz)
TEST165	165.000
DMT1660	162.000
DMT1285G	157.500
DMT1285A	148.500
DMT1648	135.000
DMT1275A	129.600
DMT1185	121.500
DMT1260G	108.000
DMT1085	94.500
DMT1170	94.200
DMT1075	78.750
DMT1070	75.000
720p60	74.250
DMT1060	65.000
DMT0885	56.250
DMT0872	50.000
DMT0875	49.500
DMT1043	44.900
DMT0860	40.000
DMT0685	36.000
DMT0785H	35.500
DMT0675	31.500
SMT0760V	28.322
DMT0660	25.175

5. Start the analyzer (see “Starting the analyzer” on page 113).

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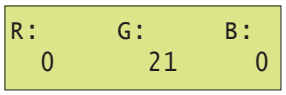
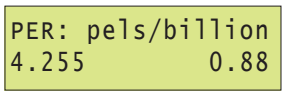
6. Press and release the **B** key to analyze the number of pixel errors detected per color component of the received HDMI/DVI signal on the LCD (see example below).



   To stop the analysis, press and release the **B** key again. The light on the key extinguishes and the analysis stops.

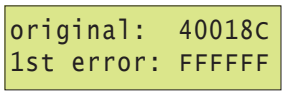
7. Press and release the **ACS** key to analyze pixel error rate (in errors per billion) and number of pixels measured (in billions) in the received HDMI/DVI signal on the LCD (see example below).

   Note: *When the number of pixel errors becomes very large, the text "Very high" is displayed in the bottom row of the LCD (replacing the numbers).*



   To stop the analysis, press and release the **ACS** key again. The light on the key extinguishes and the analysis stops.

8. Press and release the **DCS** key to view the expected and measured values for the first pixel error detected from the received HDMI/DVI signal (see example below).



   To stop the analysis, press and release the **DCS** key again. The light on the key extinguishes and the analysis stops.

9. To test the cable at a different frequency, return to step 4.

Testing accuracy of analyzer

You can verify the analyzer's ability to correctly analyze pseudo-random noise.

The procedures below provide instructions for testing the accuracy of the analyzer through the front panel. Note that you can also perform these procedures through the command line. For procedures using the command line refer to "Testing the analyzer" on page 134.

To verify the analyzer's pseudo-random noise analysis capability:

1. Connect the HDMI/DVI Tx connector to an HDMI/DVI display.
2. Using the **Format** knob, select an appropriate format for the connected HDMI/DVI display.

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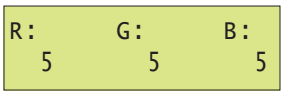
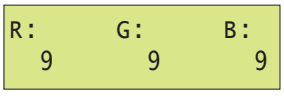
Note: *To automatically configure the Format knob list based on the EDID structure of a DDC-compliant display, hold down the R key, and then press and release the ACS key.*

3. If necessary, set the proper HDMI/DVI signal source parameters within the generator.
   - See "Starting the Analyzer Setup Utility" on page 112 for steps on viewing the current analyzer configuration.
   - You will have to configure the analyzer for an internal source. To edit HDMI/DVI signal source parameters, see "Setting up analyzer to measure timing" on page 114.
4. Configure pseudo-random noise parameters to implement a single pseudo-random noise test sequence. This requires setting the **Procedure** field to SINGLE SHOT.
   - To edit pseudo-random noise parameters, see "Setting pseudo-random noise parameters" on page 142.
5. Disconnect the HDMI/DVI Tx connector from the HDMI/DVI display.
6. Connect an HDMI/DVI cable between the HDMI/DVI Tx and Rx connectors on the generator.
7. Using the **Format** knob, select the signal format you want to use.
   - Any of the pre-defined formats can be used for this test for DVI. However, we recommend using the Test165 format to test DVI at the maximum pixel frequency (165MHz). For HDMI the Test81 format should be used.

   Note: *In order to access the test formats such as Test165, you may have to re-invoke the default format list by applying pressing and holding the R key and then pressing and releasing the ACS key.*
8. Using the **Image** knob, select either the PRN_5 or PRN_9 image.
9. Start the analyzer (see "Starting the analyzer" on page 113).
10. Press and release the **B** key to analyze number of pixel errors detected per color component of the received HDMI/DVI signal on the LCD (see example below).
    - If you selected the PRN_5 image, the following should be displayed (5 errors in each color component).

    - If you selected the PRN_9 image, the following should be displayed (9 errors in each color component).

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11. To verify accuracy using a different frequency, halt the analyzer mode and return to step 7.

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Measuring pixel errors

In cases where the external HDMI/DVI device cannot generate pseudo-random noise, a “delta error” testing capability is provided that allows analysis for flickering pixels in a still-frame test image. With the video signal connected to the analyzer input, signal quality can be measured blindly and test results delivered in simple numeric terms.

The procedures below provide instructions through the front panel. Note that you can also configure the analyzer to measure pixel errors through the command line. For procedures using the command line refer to “Pseudo-random noise generation commands” on page 132.

Setting delta error patch parameters

To enable and configure delta error patch testing by the analyzer, you must set certain analyzer parameters properly. Use the procedure to configure the analyzer to test for delta error patch testing.

To set delta error patch testing parameters:

1. Start the Analyzer Setup Utility (see page 112).
2. If necessary, see “Setting up analyzer to measure timing” on page 114 for steps to configure the appropriate HDMI/DVI signal source and timing parameters.
3. Press and release the **Step** key.

   The **Step** key illuminates and the **Analyzer Images** field is highlighted.
4. Using the **Format** knob, select the **Delta Error Patch Setup** field.
5. Using the **Image** knob, specify whether to enable (ON) or disable (OFF) delta error patch.

   If set to OFF, delta error patch is disabled and all associated fields are disabled.
6. Using the **Format** knob, select the **Travel** field.
7. Using the **Image** knob, specify how you want the patch to move across the display as follows:
   - Select Zig Zag to move over the active video in a zig zag fashion.
   - Select FIXED to move over the active video in a fixed position.
8. Using the **Format** knob, select the **Parameters** field.
9. Using the **Image** knob, specify how you want the delta error patch implemented as follows:
   - Select AUTO to allow the generator to automatically set the patch settings. The patch width and height are calculated based on size of the active video area.

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- Select MANUAL to define specific patch settings.

10. To define specific settings for delta error patch (width, height, and position), follow these steps:

    a. Using the **Format** knob, select the **Width**, **Height**, **X**, or **Y** field.

    Note: *If you selected AUTO in the Parameters field and the HDMI/DVI signal source is internal (Auto Based On field set to CURRENT), the Width and Height fields are not selectable. Similarly, if you selected AUTO in the Parameters field and the HDMI/DVI signal source is external (Auto Based On field set to MEASURE), the Width and Height fields are set when measuring the external signal's timing parameters (see "Setting up analyzer to measure timing" on page 114).*

    b. Set the parameter (in decimal) using the cursor (displayed under a digit in the field) to select the appropriate value as follows:

    - To move the cursor between digits, press the **R** and **G** keys.
    - To select a number for a digit, turn the **Image** knob.

    c. Repeat these steps until each parameter is defined.

11. Using the **Format** knob, select the **Reference Frame** field.
12. Using the **Image** knob, specify the method used to compare the patch within different frames as follows:

    - Select FIRST to use the first field as the reference for comparison with other patches in other frames.
    - Select PAIRS to set the comparison to be performed in each two successive frames.

13. Using the **Format** knob, select the **Frames Compared** field.
14. Specify the number of frames to be compared with the patch dimensions using the cursor (displayed under a digit in the field) to select the appropriate value as follows:

    - To move the cursor between digits, press the **R** and **G** keys.
    - To select a number for a digit, turn the **Image** knob.

15. Press and release the **Step** key to save the currently displayed parameters.

    The light on the **Step** key extinguishes, and the settings are implemented for Analyzer mode operation.

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Measuring pixel errors in patch

The analyzer can test and analyze the transmission quality of an external HDMI/DVI transmit device using a delta error patch pattern. The analyzer captures all or a portion of an external image (patch pattern) and verifies that all pixels match over a number of frames. The results are output to an HDMI/DVI display using a special image.

To test an external HDMI/DVI signal using delta error patch pattern:

1. Connect the HDMI/DVI transmit device to the HDMI/DVI Rx connector on the generator.
2. Connect an HDMI/DVI display to the HDMI/DVI Tx connector on the generator.
3. If necessary, set the proper HDMI/DVI signal source and delta error patch parameters within the generator.
   - See “Starting the Analyzer Setup Utility” on page 112 for steps on viewing the current analyzer configuration.
   - To edit HDMI/DVI signal source parameters, see “Setting up analyzer to measure timing” on page 114.
   - To edit delta error patch parameters, see “Setting delta error patch parameters” on page 123.
4. (HDMI only) If desired, monitor the video signal received on the HDMI Rx connector (see “Monitoring HDMI analyzer signal input” on page 110).
5. Generate a static image from the HDMI/DVI transmit device.
6. Using the **Format** knob, select an appropriate format for the connected HDMI/DVI display.

   Note: *To automatically configure the Format knob list based on the EDID structure of a DDC-compliant display, hold down the* **R** *key, then press and release the* **ACS** *key.*

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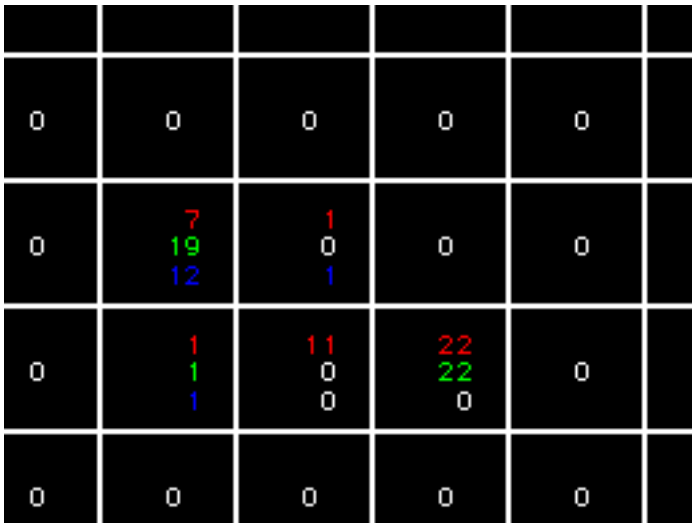
7. Using the **Image** knob, select the DeltaErr image.

   The DeltaErr image appears on the connected HDMI/DVI display. As shown in the example below, errors are presented in the area in which they are found by color component.



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Testing InfoFrames (HDMI only)

The HDMI analyzer can analyze InfoFrame data from an incoming HDMI signal. With this capability, an HDMI transmit device can be tested for its ability to transmit InfoFrame packets correctly.

Testing HDMI transmit device InfoFrame capability

The 802 generator can monitor the InfoFrame content of the received HDMI signal.

To view current HDMI InfoFrame contents received from an HDMI transmitter:

1. Connect an HDMIdisplay to the HDMI Tx connector on the generator.
2. Connect the HDMI source to the HDMI Rx connector on the generator.
3. Setup the generator for HDMI output (see page 147).
4. If desired, monitor the video signal received on the HDMI Rx connector (see “Monitoring HDMI analyzer signal input” on page 110).
5. Using the **Format** knob, select an appropriate format for the connected HDMI/DVI display.

   Note: *To automatically configure the Format knob list based on the EDID structure of a DDC-compliant display, hold down the* **R** *key, then press and release the* **ACS** *key.*

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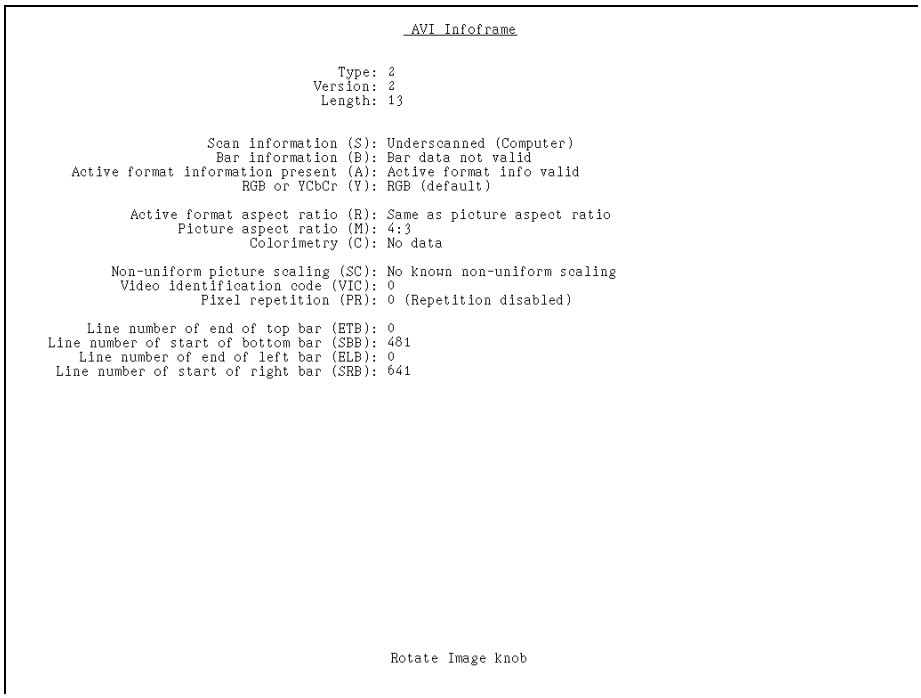
6. Using the **Image** knob, select the PacketRx image.

   The PacketRx image appears on the connected HDMI display. Shown in the image are the current settings for the AVI InfoFrame input.


AVI Infoframe
Type: 2
Version: 2
Length: 13
Scan information (S): Underscanned (Computer)
Bar information (B): Bar data not valid
Active format information present (A): Active format info valid
RGB or YCbCr (Y): RGB (default)
Active format aspect ratio (R): Same as picture aspect ratio
Picture aspect ratio (M): 4:3
Colorimetry (C): No data
Non-uniform picture scaling (SC): No known non-uniform scaling
Video identification code (VIC): 0
Pixel repetition (PR): 0 (Repetition disabled)
Line number of end of top bar (ETB): 0
Line number of start of bottom bar (SBB): 481
Line number of end of left bar (ELB): 0
Line number of start of right bar (SRB): 641
Rotate Image Knob

7. Press and release the **Step** key.

   The **Step** key illuminates.

8. Using the **Image** knob, select the appropriate InfoFrame type.

   The contents of the appropriate InfoFrame input are displayed on the HDMI display.

9. When finished, press and release the **Step** key.

   The light on the **Step** key extinguishes.

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Testing audio (HDMI only)

The HDMI analyzer can process audio data from an incoming HDMI signal. With this capability, an HDMI source can be tested for its ability to successfully transmit audio packets.

Testing HDMI transmit device audio capability

The 802 generator can monitor the audio content of the received HDMI signal.

To monitor audio content received from an HDMI transmitter:

1. Connect the HDMI transmit device to the HDMI Rx connector on the generator.
2. If necessary, set up the generator for HDMI output (see “Setting up the generator for HDMI operation” on page 147).
3. Monitor the audio signal received on the HDMI Rx connector using an external audio device (see “Monitoring HDMI analyzer signal input” on page 110.

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Controlling analyzer using command-line interface

You can operate the Analyzer using the 802 generator's command line interface. This section describes Analyzer functions and commands and provides examples of command sequences you can use to perform Analyzer tasks.

For command descriptions, see Appendix A, "Command Reference."

Signal timing analysis commands

This section provides command line procedures for viewing signal timing parameters.

Viewing signal timing parameters (on an HDMI/DVI monitor)

This example displays timing and allows you to view real-time, detailed HDMI/DVI signal timing information from a connected HDMI/DVI transmit device.

To view basic timing information of an external HDMI/DVI source signal:

1. Connect the HDMI/DVI transmit device to the HDMI/DVI Rx connector on the generator.
2. If desired, monitor the video signal received on the HDMI/DVI Rx connector (see page 110).
3. Using a terminal emulator, establish a terminal connection with the generator. Refer to "Setting up a terminal connection with the generator" on page 14.
4. Enter the following commands to configure the generator to output a digital signal (HDMI or DVI):

   ```
   SROP 2 4
   ```

   This removes analog friendly mode and configures the generator to output either a DVI or HDMI signal depending on the interface hardware the generator is equipped with (DVI or HDMI).
5. (optional) Enter the following command to set the status display mode:

   ```
   SROP 8
   ```
6. Enter the following commands to initiate the measurement of timing parameters.

   ```
   ANIG 1        // enables analyzer images to be displayed
   IMGL FormatRx // loads the FormatRX image into the edit buffer
   IMGU          // applies the FormatRX image to the generator/analyzer
   ```

Viewing specific timing parameters

The following is an example of using commands to view the total number of horizontal pixels and horizontal frequency of the HDMI/DVI signal.

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To view specific timing information of an external HDMI/DVI source signal:

1. Connect the HDMI/DVI transmit device to the HDMI/DVI Rx connector on the generator.
2. Using a terminal emulator, establish a terminal connection with the generator. Refer to “Setting up a terminal connection with the generator” on page 14.
3. Enter the following commands to configure the generator to output a digital signal (HDMI or DVI):

   ```
   SROP 2 4
   ```

   This removes analog friendly mode and configures the generator to output either a DVI or HDMI signal depending on the interface hardware the generator is equipped with (DVI or HDMI).
4. (optional) Enter the following command to set the status display mode:

   ```
   SROP 8
   ```
5. Enter the following commands to initiate the measurement of timing parameters.

   ```
   PNSF 1    // selects the source of timing information as "Measured"
   TMAU      // initiates measurement of timing from external source
   HTOT?     // queries for the horizontal total pixels
   HRES?     // queries for the horizontal active pixels
   ```

   See page 548 for additional parameters you can query.

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Pseudo-random noise generation commands

This section provides command line procedures for generating pseudo-random noise.

Generating pseudo-random noise

The following is an example of using commands to first configure and then generate pseudo-random noise.

To generate pseudo-random noise:

1. Using a terminal emulator, establish a terminal connection with the generator. Refer to “Setting up a terminal connection with the generator” on page 14.
2. Enter the following commands to configure the generator to output a digital signal (HDMI or DVI):

   ```
   SROP 2 4
   ```

   This removes analog friendly mode and configures the generator to output either a DVI or HDMI signal depending on the interface hardware the generator is equipped with (DVI or HDMI).
3. (optional) Enter the following command to set the status display mode:

   ```
   SROP 8
   ```
4. Enter the following commands to generate pseudo-random noise.

   ```
   PNSF 0  // selects internal timing source for pseudo-random noise
   PNST 1  // specifies QDI-BCM algorithm
   PNSA 1  // sets pseudo random noise to be calculated each pixel clock
   PNSM 0  // sets pseudo random noise test to run in auto mode
   PNSP 0  // sets procedure for pseudo-random noise test to “continuous”
   PNSG 1  // enables the pseudo-random noise test
   PNGU    // turns on the pseudo-random noise test
   <CR>    // a carriage return halts the continuous test
   ```
5. Enter the following commands to stop pseudo-random noise generation.

   ```
   PNSG 0
   PNGU
   ```

Pseudo-random noise analysis commands

This section provides command line procedures for generating pseudo-random noise and analyzing the received data.

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Analyzing pseudo-random noise in a cable or distribution system

The following example uses commands to test a connected HDMI/DVI cable or distribution system.

To analyze pseudo-random noise in a cable or distribution system:

1. Connect the DVI or HDMI cable between the transmit and receive connectors on the generator.

   If you are testing a distribution system connect an access cable to the distribution center to the transmit connector on the generator and a second access cable to the receive connector on the generator.

2. Using a terminal emulator, establish a terminal connection with the generator. Refer to “Setting up a terminal connection with the generator” on page 14.

3. Enter the following commands to configure the generator to output a digital signal (HDMI or DVI):

   ```
   SROP 2 4
   ```

   This removes analog friendly mode and configures the generator to output either a DVI or HDMI signal depending on the interface hardware the generator is equipped with (DVI or HDMI).

4. (optional) Enter the following commands to set the status display mode:

   ```
   SROP 8
   ```

5. Enter the following commands to analyze pseudo-random noise in a cable or distribution system.

   ```
   FMTL TEST165 // loads the TEST165 format for testing DVI
   ```

   Note: *For HDMI testing load the TEST81 format.*

   ```
   FMTU       // applies the TEST165 or TEST81 format to the generator
   ```

6. Enter the following commands to configure the pseudo-random noise parameters.

   ```
   PNSF 0     // selects internal timing source for pseudo-random noise
   PNST 1     // specifies QDI-BCM algorithm
   PNSA 1     // sets pseudo random noise to be calculated each pixel
   PNSM 0     // sets pseudo random noise test to run in auto mode
   PNSP 100   // sets pseudo-random noise for 100 “multi-shots”
   PNAU       // loads the generator with pseudo-random noise settings
   ```

   Note: *The test will stop automatically if configured to run in the single or multi-shot mode. If you initiate the test in the continuous mode, you will have to enter a carriage return to halt the test after PNAU is invoked.*

7. Enter the following commands to view the results of the test.

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```
GPER?      // returns the pixel error rate in errors per billion
GNPT?      // returns the number of pixels measured in billions
GCET?      // returns the number of bad pixels for R, G, B components
GFED?      // returns information about the first error encountered
```

Analyzing pseudo-random noise from an external source

The following example tests an HDMI/DVI transmit device's pixel data using pseudo-random noise generated by an external source.

To analyze pseudo-random noise from an external source:

1. Connect the DVI or HDMI cable between the receive connector on the generator and the output interface on the device under test.
2. Using a terminal emulator, establish a terminal connection with the generator. Refer to "Setting up a terminal connection with the generator" on page 14.
3. Enter the following commands to configure the generator to output a digital signal (HDMI or DVI):

   ```
   SROP 2 4
   ```

   This removes analog friendly mode and configures the generator to output either a DVI or HDMI signal depending on the interface hardware the generator is equipped with (DVI or HDMI).
4. (optional) Enter the following commands to set the status display mode:

   ```
   SROP 8
   ```
5. Enter the following commands to configure the pseudo-random noise parameters.

   ```
   PNSF 1     // selects external timing source for pseudo-random noise
   PNST 1     // specifies QDI-BCM algorithm
   TMAU       // initiates measurement of timing from external source
   PNSA 1     // sets pseudo random noise to be calculated each pixel
   PNSM 0     // sets pseudo random noise test to run in auto mode
   PNSP 100   // sets pseudo-random noise for 100 "multi-shots"
   PNAU       // loads the generator with the pseudo-random noise settings
   ```

   Note: *The test will stop automatically if configured to run in the single or multi-shot mode. If you initiate the test in the continuous mode, you will have to enter a carriage return to halt the test after PNAU is invoked.*
6. Enter the following commands to view the results of the test.

   ```
   GPER?      // returns the pixel error rate in errors per billion
   GNPT?      // returns the number of pixels measured in billions
   GCET?      // returns the number of bad pixels for R, G, B components
   GFED?      // returns information about the first error encountered
   ```

Testing the analyzer

The following example verifies the analyzer's pseudo-random noise analysis capability.

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To verify the analyzer's pseudo-random noise analysis capability:

1. Using a terminal emulator, establish a terminal connection with the generator. Refer to "Setting up a terminal connection with the generator" on page 14.
2. Enter the following commands to configure the generator to output a digital signal (HDMI or DVI):

   ```
   SROP 2 4
   ```

   This removes analog friendly mode and configures the generator to output either a DVI or HDMI signal depending on the interface hardware the generator is equipped with (DVI or HDMI).
3. (optional) Enter the following commands to set the status display mode:

   ```
   SROP 8
   ```
4. Connect an HDMI/DVI cable between the HDMI/DVI Tx and Rx connectors on the generator.
5. Enter the following commands to select the signal format and image.

   ```
   FMTL TEST165 // loads the TEST165 format
   ```

   Note: *For HDMI testing load the TEST81 format.*

   ```
   FMTU         // applies the TEST165 or TEST81 format to the generator
   IMGL PRN_9   // loads the PRN_9 image
   IMGU         // activates the image in the generator
   ```
6. Enter the following commands to set the pseudo-random noise parameters.

   ```
   PNSF 0       // selects internal timing source for pseudo-random noise
   PNST 1       // specifies QDI-BCM algorithm
   PNSA 1       // sets pseudo random noise to be calculated each pixel
   PNSM 0       // sets pseudo-random noise test to "single-shot"
   PNAU         // loads the generator with pseudo-random noise settings
   ```

   Note: *The test will stop automatically if configured to run in the single or multi-shot mode. If you initiate the test in the continuous mode, you will have to enter a carriage return to halt the test after PNAU is invoked.*

7. Enter the following commands to view the results of the test.

   ```
   GPER?      // returns the pixel error rate in errors per billion
   GNPT?      // returns the number of pixels measured in billions
   GCET?      // returns the number of bad pixels for R, G, B components
   GFED?      // returns information about the first error encountered
   ```

Analyzing pixel data (delta error patch)

The following is an example of using commands to test an HDMI/DVI transmit device's pixel data using a delta error patch test.

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To set delta error patch testing parameters:

1. Using a terminal emulator, establish a terminal connection with the generator. Refer to “Setting up a terminal connection with the generator” on page 14.
2. Enter the following commands to configure the generator to output a digital signal (HDMI or DVI):

   ```
   SROP 2 4
   ```

   This removes analog friendly mode and configures the generator to output either a DVI or HDMI signal depending on the interface hardware the generator is equipped with (DVI or HDMI).
3. (optional) Enter the following commands to set the status display mode:

   ```
   SROP 8
   ```
4. Connect the HDMI/DVI transmit device to the HDMI/DVI Rx connector on the generator.
5. Connect an HDMI/DVI display to the HDMI/DVI Tx connector on the generator.
6. Enter the following commands to load a suitable format for the display under test.

   ```
   FMTL DMT0660 // loads the DMT0660 format for testing
   FMTU         // applies the DMT0660 format to the generator
   ```
7. Enter the following commands to load a suitable static image.

   ```
   IMGL FLAT    // loads the static image for testing
   IMGU         // applies the image to the generator
   ```
8. Enter the following commands to configure the delta patch parameters.
9. ```
   PDSX 128        // sets patch starting at x-pixel 128
   PDSY 256        // sets patch starting at y-pixel 256
   PDSH 64         // sets patch height at 64 pixel
   PDSW 96         // sets patch width at 90 pixels
   ```
10. Enter the following commands to run the delta patch test.

    ```
    PDAU            // captures patch of image
    ANIG 1          // enables analyzer images
    IMGL DeltaErr   // loads the DeltaErr image
    IMGU            // activates the image in the generator
    ```


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    ```

Generating pseudo-random noise from your device

This section explains how to implement pseudo-random noise is your own device.

Implementing pseudo-random noise from your device

The analyzer can test and analyze pixel data received from an HDMI/DVI source. To accomplish this, a pseudo-random noise pattern is used that provides a sequence of highly dynamic pixel values.

To maximize your ability to analyze pixel data generated by set-top boxes, you must be able to generate pseudo-random noise. To facilitate this, you can use the lfsr.h and lfsl.cpp source code files from http://www.quantumdata.com/support/resources/pr_noise/QDI-BCM_PseudoNoise.ZIP, which enable you to generate QDI-BCM pseudo-random noise from your device.

Once implemented, you can verify that the code is implemented correctly by using the Dump10K() function to write the first 10,000 pixel values to a file. This result should match the contents of the PN_31_24.txt reference file included in http://www.quantumdata.com/support/resources/pr_noise/QDI-BCM_PseudoNoise.ZIP.

lfsr.h

The following source code is provided for the lfdr.h file.

```
// LFSR.h: interface for the CLFSR class.

#if !defined(AFX_LFSR_H__5947F6F9_1DBE_4E6E_9AFB_77D5D8857A10__INCLUDED_)
#define AFX_LFSR_H__5947F6F9_1DBE_4E6E_9AFB_77D5D8857A10__INCLUDED_

#if _MSC_VER > 1000
#pragma once
#endif // _MSC_VER > 1000

class CLFSR
{
public:
     void Dump10K();
     unsigned long GetPixel();
     void Reset();
     CLFSR();
     virtual ~CLFSR();

protected:
     int state;
     unsigned long seed;
};
```


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```
#endif //
!defined(AFX_LFSR_H__5947F6F9_1DBE_4E6E_9AFB_77D5D8857A10__INCLUDED_)
```

lfsl.cpp

The following source code is provided for the tfsl.cpp file.

```
// Implementation of the CLFSR class
#include "LFSR.h"
#include <stdio.h>
#ifdef _DEBUG
#undef THIS_FILE
static char THIS_FILE[]=__FILE__;
#define new DEBUG_NEW
#endif

// enable this to light up pixels 1,2,3 as red,green,blue
// in horizontal order
// Pixel 1 represents the top left corner of the screen
// when this is enabled, all other pixels are black
//#define RGB_TEST

// Construction/Destruction

unsigned long pixelvalue;

CLFSR::CLFSR()
{

}

CLFSR::~CLFSR()
{

}

void CLFSR::Reset()
{
     state=0;
     seed=0x08000001;

}

// Pixel 1 should be 0x000000
// Pixel 2 should be 0x00 (7-bits) , Opcode(10-bits),  SeedHigh(7 bits)
// Pixel 3 should be SeedLow (24 bits)
// All other pixels are then set based on the results of the LFSR
calculations.
// The 10-bit Opcode is custom per Quantum Data's request and it will be
set to '00,0000,0111'.
unsigned long CLFSR::GetPixel()
{
     unsigned long temp;
```


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```
     // states 0 to 2 are specific for QuantumData
     switch (state)
     {
     // pixel 1
     case 0:
               pixelvalue=seed;
               state++;

#ifdef RGB_TEST
               return (0xff0000); // red
#else
               return(0);
#endif
               break;

     // pixel 2
     case 1:
               temp=((0x007<<7) | (( seed &0x7f000000)>>24)) & 0xffffff;
               state++;
#ifdef RGB_TEST
               return (0x00ff00); // green
#else
               return(temp);
#endif
               break;

     // pixel 3
     case 2:
               temp=seed &0x00ffffff;
               state++;
#ifdef RGB_TEST
               return (0x0000ff); // blue
#else
               return(temp);
#endif
               break;

     default:


               pixelvalue= ((pixelvalue & 0x7f)<<24) | ( ((pixelvalue>>4)
& 0xffffff) ^ ((pixelvalue>>7) & 0xffffff) );
#ifdef RGB_TEST
               return (0x0); // blank
#else
               return(pixelvalue & 0xffffff);
#endif
               break;
               break;
     }
```


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```
}

void CLFSR::Dump10K()
{
     int i;
     FILE* f;
     char s[100];
     f=fopen("c:\\temp\\noise.txt","w");
     Reset();
     for (i=0;i<10000;i++)
     {
          sprintf(s,"%.61x",GetPixel());
          fprintf(f,"%s\r\n",s);
     }

//     AfxMessageBox("See c:\\temp\\noise.txt");
     fclose(f);
```

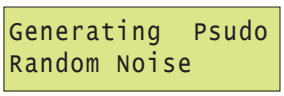
Sending pseudo-random noise to external device

The analyzer can be the source for a pseudo-random noise test pattern. HDMI/DVI displays can use this test pattern for testing and analysis purposes.

To generate a pseudo-random noise test pattern:

1. Connect the HDMI/DVI receiver device to the HDMI/DVI Tx connector on the generator.
2. If necessary, set the proper pseudo-random noise parameters within the generator.
   - See "Starting the Analyzer Setup Utility" on page 112 for steps on viewing the current analyzer configuration.
   - To edit pseudo-random noise parameters, see "Setting pseudo-random noise parameters" on page 142.
3. Place the generator in HDMI/DVI analyzer mode.
   - See "Starting the analyzer" on page 113 for steps on launching analyzer mode.
4. Press and release the **Step** key to generate pseudo-random noise to be transmitted.

   The key illuminates and pseudo-random noise is transmitted from the HDMI/DVI Tx connector. The following message appears on the LCD:

5. To stop pseudo-random noise generation, press and release the **Step** key.

   The light on the key extinguishes and pseudo-random noise is no longer transmitted.

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Analyzing noise from an external device

The analyzer can test and analyze the transmission quality of an external HDMI/DVI transmit device using pseudo-random noise.

Important: *To perform this test, the external HDMI/DVI transmit device must be able to generate pseudo-random noise using the QDI-BCM format.*

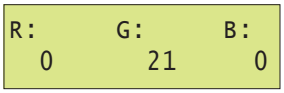
Note: *Before performing this test, you may first want to test the cables and distribution equipment used to transport the HDMI/DVI signal between the external device and generator. For more information, see "Testing cables and distribution systems" on page 118.*

To test an external HDMI/DVI signal using pseudo-random noise:

1. Connect the HDMI/DVI transmit device to the HDMI/DVI Rx connector on the generator.
2. If necessary, set the proper HDMI/DVI signal source and pseudo-random noise parameters within the generator.
   - See "Starting the Analyzer Setup Utility" on page 112 for steps on viewing the current analyzer configuration.
   - To edit HDMI/DVI signal source parameters, see "Setting up analyzer to measure timing" on page 114.

   Note: *The HDMI/DVI signal source must be set to external (***Auto Based On** *field set to* MEASURED*) for this procedure.*

   - To edit pseudo-random noise parameters, see "Setting pseudo-random noise parameters" on page 142.
3. If desired, monitor the video/audio signal received on the HDMI Rx connector (see "Monitoring HDMI analyzer signal input" on page 110).
4. Start the analyzer (see page 113).
5. Generate pseudo-random noise from the HDMI/DVI transmit device.
6. Press and release the **B** key to analyze the number of pixel errors detected per color component of the received HDMI/DVI signal (see example below).

   To stop the analysis, press and release the **B** key again. The light on the key extinguishes and the analysis stops.

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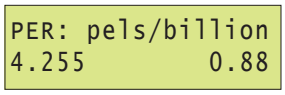
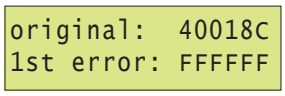
7. Press and release the **ACS** key to analyze pixel error rate (in errors per billion) and number of pixels measured (in billions) in the received HDMI/DVI signal on the LCD (see example below).



Note: *When the number of pixel errors becomes very large, the text "Very high" is displayed in the bottom row of the LCD (replacing the numbers).*

To stop the analysis, press and release the **ACS** key again. The light on the key extinguishes and the analysis stops.

8. Press and release the **DCS** key to analyze the expected and reported values for the first pixel error detected from the received HDMI/DVI signal on the LCD (see example below).



To stop the analysis, press and release the **DCS** key again. The light on the key extinguishes and the analysis stops.

Setting pseudo-random noise parameters

This section describes how to modify the pseudo-random noise output by the generator.

To set pseudo-random noise parameters:

1. Start the Analyzer Setup Utility (see "Starting the Analyzer Setup Utility" on page 112).
2. If necessary, see "Setting up analyzer to measure timing" on page 114 for steps to configure the appropriate HDMI/DVI signal source and timing parameters.
3. Press and release the **Step** key.

   The **Step** key illuminates and the **Analyzer Images** field is highlighted.
4. Using the **Format** knob, select the **Pseudo Random Noise Setup** field.
5. Using the **Image** knob, specify whether to enable (ON) or disable (OFF) pseudo-random noise.

   If set to OFF, pseudo-random noise is disabled and all associated fields are disabled.
6. Using the **Format** knob, select the **Advance after Every** field.
7. Using the **Image** knob, specify how you want pseudo-random noise generated, as follows:

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- Select PIXEL to generate and receive pseudo-random noise at every pixel within the whole frame.
- Select ACTIVE PIXEL to generate and receive pseudo-random noise only at active pixels within the frame.

8. Using the **Format** knob, select the **Parameters** field.
9. Using the **Image** knob, specify how you want the pseudo-random noise seed and sequence length implemented, as follows:
   - Select AUTO to use the default seed value and sequence length. The default settings ensure a stable, pseudo-random noise image. If you select this setting, proceed to step 11.
   - Select MANUAL to define specific seed value and sequence length settings. If you select this setting, proceed to step 10.

   Note: *If the HDMI/DVI signal source is external (***Auto Based On** *field set to* MEASURED*), you cannot manually define these settings. The* **Parameters** *and* **Seed Value(Hex)** *fields appear dimmed, and the* **Run Length(Hex)** *field is set when measuring the external signal's timing parameters (see "Setting up analyzer to measure timing" on page 114).*

10. If you set the **Parameters** field to MANUAL, define specific settings for pseudo-random noise seed and sequence length by following these steps:
    a. Using the **Format** knob, select the **Seed Value(Hex)** field.
    b. Specify the desired seed value using the cursor (displayed under a digit in the field) to select the appropriate value as follows:
       - To move the cursor between digits, press the **R** and **G** keys.
       - To select a number for a digit, turn the **Image** knob.
    c. Using the **Format** knob, select either the **Run-Length(Hex)** or **Run-Length(Dec)** field.
    d. Specify the desired sequence length value in hexidecimal (if **Run-Length(Hex)** field is highlighted) or decimal (if **Run-Length(Dec)** field is highlighted) using the cursor (displayed under a digit in the field) to select the appropriate value as follows:
       - To move the cursor between digits, use the **R** and **G** keys.
       - To select a number for a digit, use the **Image** knob.
11. Using the **Format** knob, select the **Procedure** field.
12. Using the **Image** knob, select the sequence type for pseudo-random noise to be generated and tested as follows:
    - Select CONTINUOUS to run the pseudo-random noise sequence continuously.
    - Select SINGLE SHOT to run one sequence of pseudo-random noise.

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- Select MULTI SHOT to define a specific number of sequences to run. Define the number of sequences to run in the field next to the Procedure field.

13. Press and release the **Step** key to save the currently displayed parameters.

    The light on the **Step** key extinguishes, and the settings are implemented for analyzer mode operation.

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9 Testing HDMI Sink Devices

Topics in the chapter:

- Overview
- HDMI connections
- Getting started
- Testing HDMI video
- Testing HDMI audio
- Testing HDMI InfoFrames

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Overview

The HDMI option enables the generator to test HDMI-compliant sink devices. With the HDMI option, the generator outputs HDMI-compatible TMDS video and data packets containing audio and auxiliary information.

The HDMI option includes the following features:

- Advanced E-EDID parsing
- Generation of all EIA/CEA-861-B formats below 165 MHz (with all possible variations)
- Pixel repetition test capabilities
- Internal sine wave generator and external SPDIF audio input for audio testing
- AFD test capabilities
- Automatic and manual InfoFrame configuration

Note: *This chapter refers to the EIA/CEA-861B standard, which may be purchased from http://global.ihs.com/*

For HDMI compliance testing procedures, see "Testing EDID in HDMI sink device for HDMI compliance" on page 173.

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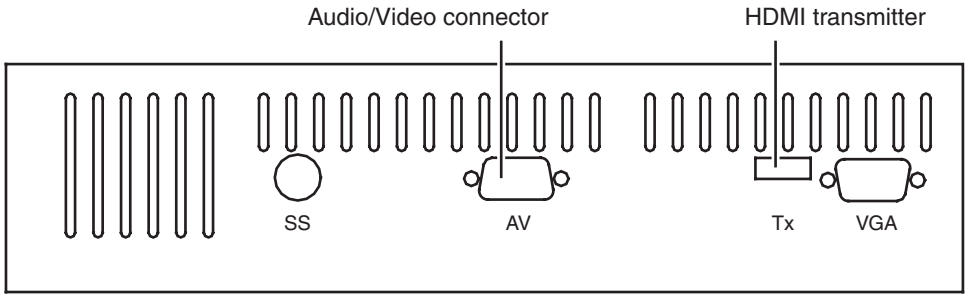
Getting started

This section provides basic information on how to operate the 802 generator using the HDMI option.

HDMI connections

The generator with the HDMI option has two connectors. In addition to an HDMI Tx (output) connector that emulates an HDMI source device, an AV connector allows external SPDIF audio to be input to the HDMI signal. To use the AV port, an RCA-to-VGA cable is included with the generator.

The following figure shows the location of these connectors on a model 802 generator with the HDMI option.



Setting up the generator for HDMI operation

To perform testing using the HDMI option, you must ensure that the generator is configured to output HDMI signals:

To set up the generator to perform HDMI testing:

1. Hold down the **G** and **B** keys, and then power on the generator.

   The following message appears on the front panel LCD.

   ```
   Special:     keys
   Digital friendly
   ```

2. Release the **G** and **B** keys.

   The generator is placed in Digital Friendly mode.

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3. Hold down the **R** and **ACS** keys, and then cycle the power to the generator.

   The following message appears on the front panel LCD.

   ```
   Special:     keys
   hot-plug  formats
   ```

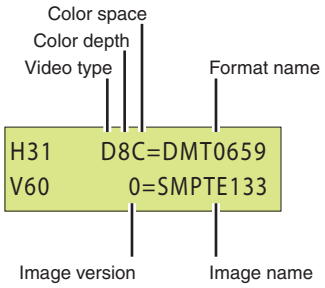
4. Release the **R** and **ACS** keys.

   The generator is placed in Hot-Plug Format mode. This loads the Format knob list with formats supported by the connected HDMI display (hot-plug formats read via EDID structure of attached display).

   Note: *To toggle between the factory default and hot-plug Format knob lists, press and release the R and ACS keys. Using the factory default Format knob list will disable the generator's ability to automatically select the appropriate output signal protocol (HDMI or DVI) as performed in step 6. In this case, you must manually select the proper TMDS output signal via Toggle DVI/HDMI key operation (R and G keys).*

5. Hold down the **Step**, **G**, and **B** keys while starting the genertor, until *Status display* appears on the LCD.

6. Release the **Step**, **G**, and **B** keys to enable status display on the generator (see example below).



   The format status on the LCD will indicate whether the unit is outputting HDMI or DVI signal protocol from the Tx connector. An "H" in the format status (H8C in the example above) indicates HDMI output; a "D" in the format status indicates DVI output.

   Note: *With the compliant Hot-plug Formats mode active and a hot-plug detected, the generator automatically selects the appropriate TMDS output signal protocol (HDMI or DVI) for the attached display (via EDID read).*

7. If the output signal protocol is DVI, toggle to HDMI protocol by holding down the **R** key, then pressing and releasing the **G** key.

   The format status changes to "H" (from "D") on the LCD.

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Testing HDMI video

This section provides steps on how to test handling of HDMI video signals by an HDMI display. To support HDMI, the generator provides pre-defined formats for every video format specified in the EIA/CEA-861-B standard. These pre-defined formats support all aspects of the HDMI signal (video, audio, and auxiliary data).

The following table lists the generator formats used to test support for HDMI (EIA/CEA-861-B) formats.

EIA/CEA-861-B Video Identification Code	Quantum Data format
1	DMT0659, DMT0660
2	480p59, 480p60, 480p59LH, 480p60LH
3	480p59SH, 480p60SH
4	720p59, 720p60
5	1080i29, 1080i30
6	480i2x29, 480i2x30, 480i2xL1, 480i2xL2
7	480i2xS1, 480i2xS2
8	240p2x_1, 240p2x_2, 240p2x_3, 240p2x_4, 240p2xL1, 240p2xL2, 240p2xL3, 240p2xL4
9	240p2xS1, 240p2xS4, 240p2xS3, 240p2xS4
10	480i4x29, 480i4x30, 480i4xL1, 480i4xL2
11	480i4xS1, 480i4xS2
12	240p4x_1, 240p4x_2, 240p4x_3, 240p4x_4, 240p4xL1, 240p4xL2, 240p4xL3, 240p4xL4
13	240p4xS1, 240p4xS2, 240p4xS3, 240p4xS4
14	480p2x59, 480p2x60, 480p2xL1, 480p2xL2
15	480p2xS1, 480p2xS2
16	1080p59, 1080p60
17	576p50, 576p50LH
18	576p50SH
19	720p50
20	1080i25
21	576i2x25, 576i2xLH
22	576i2xSH
23	288p2x_1, 288p2x_2, 288p2x_3, 288p2xL1, 288p2xL2, 288p2xL3

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EIA/CEA-861-B Video Identification Code	Quantum Data format
24	288p2xS1, 288p2xS2, 288p2xS3
25	576i4x25, 576i4xLH
26	576i4xSH
27	288p4x_1, 288p4x_2, 288p4x_3, 288p4xL1, 288p4xL2, 288p4xL3
28	288p4xS1, 288p4xS2, 288p4xS3
29	576p2x50, 576p2xLH
30	576p2xSH
31	1080p50
32	1080p23, 1080p24
33	1080p25
34	1080p29, 1080p30

Testing HDMI video formats

Basic testing requires verifying proper handling of those video formats supported by the HDMI display. Using the table above as a guide, you can verify your display's support for one or more EIA/CEA-861-B formats.

To test an HDMI display using supported HDMI formats:

1. Connect an HDMI display to the Tx connector on the generator.
2. If necessary, set up the generator for HDMI output.
   - See "Setting up the generator for HDMI operation" on page 147 for steps on setting up the generator for HDMI operation.
3. Using the **Format** knob, specify the HDMI video format you want to test.

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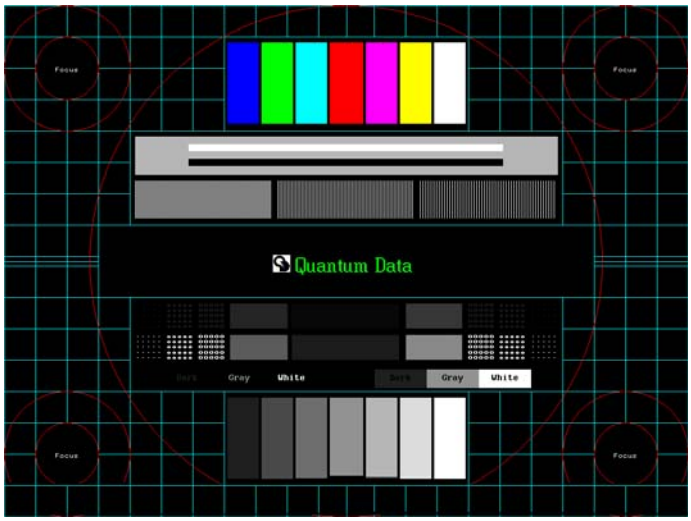
4. Using the **Image** knob, select the Master image.

   The Master image appears on the connected HDMI display (as shown below).



5. To verify proper handling of the selected HDMI video format, check for the following in the image on the HDMI display:
   - scrambled raster
   - jitter
   - centering
   - scaling anomalies
   - resolution patches (for clarity)
   - sparkling or missing pixels

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6. Using the **Image** knob, select the Ramp image.

   The Ramp image appears on the connected HDMI display (as shown below).

7. To verify proper handling of the selected HDMI video format, check for glitches in the image on the HDMI display.
8. Using the **Image** knob, select additional images (as desired) to verify proper handling of the selected HDMI video format.
9. To test another HDMI format, return to step 3.

Testing HDMI video pixel repetition

The EIA/CEA-861-B standard defines a number of progressively-scanned gaming formats which support variable horizontal resolution. These formats maintain a fixed 2880-pixel format timing and use pixel repetition to provide 10 different effective horizontal resolutions. A special blanking scheme further reduces the number of active pixels (to those listed in the table below), thereby providing a horizontal safe area that insures that all of the pixels in a game will be visible on overscanned HDMI displays.

To support HDMI gaming format and pixel repetition testing, the generator allows you to sequentially apply pixel repetition (up to 10 times) to a unique image. As the pixel repetition factor is increased, the horizontal resolution of the displayed image will decrease as shown the table below.

Pixel repetition factor (image version)	Horizontal resolution
0	2880 pixels/line
1	2560 pixels/line
2	1280 pixels/line

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Pixel repetition factor (image version)	Horizontal resolution
3	853 pixels/line
4	640 pixels/line
5	512 pixels/line
6	427 pixels/line
7	366 pixels/line
8	320 pixels/line
9	284 pixels/line
10	256 pixels/line

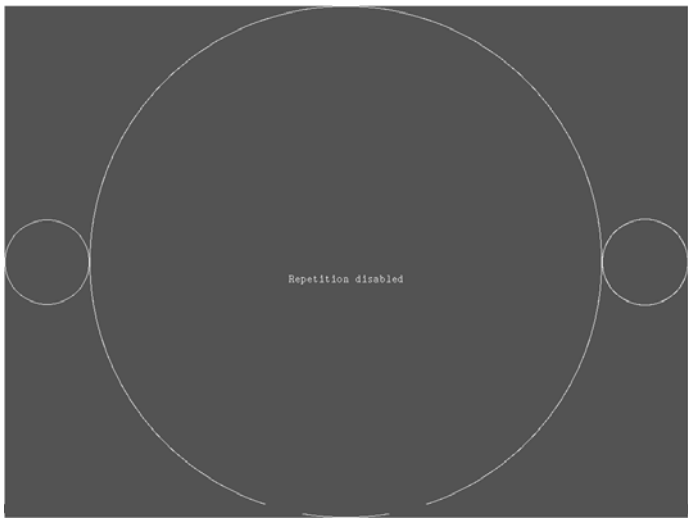
To test an HDMI display using HDMI pixel repetition:

1. Connect an HDMI display to the Tx connector on the generator.
2. If necessary, set up the generator for HDMI output.
   - See “Setting up the generator for HDMI operation” on page 147 for steps on setting up the generator for HDMI operation.
3. Using the **Format** knob, select the HDMI gaming format you want to test.

   Note: *Gaming formats on the generator have the characters "4x" in their names (such as “480i4x29” or “576i4x25”). For a listing of all HDMI formats, see the table on page 149.*

4. Using the **Image** knob, select the PixelRep image.

   The PixelRep image appears on the connected HDMI display (as shown below).



5. Press and release the **Step** key.

   The **Step** key illuminates.

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6. Using the **Image** knob, select the appropriate image version number (1-10).

   Note: *The image version number correlates with the pixel repetition factor.*

   The pixel repetition factor appears in the center of the image.

7. To verify proper handling of the selected HDMI gaming format, check the following in the image on the HDMI display:
   - The horizontal active area is resized to the appropriate number of clocked pixels using vertical bars to the left and right of the default (2880 pixel) image.
   - The white vertical borders and circles in the active area appear thicker.
   - The white text in the center of the active area appears stretched and bigger.
8. Using the **Image** knob, select additional pixel repetition factors (as desired) to verify proper handling of the selected HDMI gaming format using variable horizontal resolutions.
9. When finished, press and release the **Step** key.

   The light on the **Step** key extinguishes.

10. To test another HDMI gaming format, return to step 3.

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Testing HDMI audio

This section provides steps on how to test handling of audio packets by an HDMI display. Testing can be performed using audio originating from both internal (generator) and external sources. The generator supports both 2-channel SPDIF audio from internal source and external source and up to 8-channel audio from an internal audio source. There are seperate sets of images for testing 2-channel SPDIF audio and 8-channel audio.

Testing 2-channel HDMI audio output from internal SPDIF source

To support testing of HDMI audio, the 802 generator provides two-channel LPCM audio (using an internally-generated sinewave) at the highest audio sampling rate (48 kHz). Multiple scenarios are provided that allow you to test one or both audio channels at different amplitudes and frequencies, as well as test using the different supported sampling rates.

The following table lists the images used to perform HDMI audio testing using an internal audio source.

Image	Description
AudioLR	Left and right audio channel output with adjustable amplitude.
AudioLRf	Left and right audio channel output with adjustable frequency.
AudioRAT	Left and right audio channel output with adjustable sampling rate.
Audio_L	Left audio channel output with adjustable amplitude.
Audio_Lf	Left audio channel output with adjustable frequency.
Audio_R	Right audio channel output with adjustable amplitude.
Audio_Rf	Right audio channel output with adjustable frequency.

To test an HDMI display using HDMI audio from the generator:

1. Connect an HDMI display to the Tx connector on the generator.
2. If necessary, set up the generator for HDMI output.
   - See “Setting up the generator for HDMI operation” on page 147 for steps on setting up the generator for HDMI operation.
3. Using the **Format** knob, select either the DMT0660 or 480i2x29 format.

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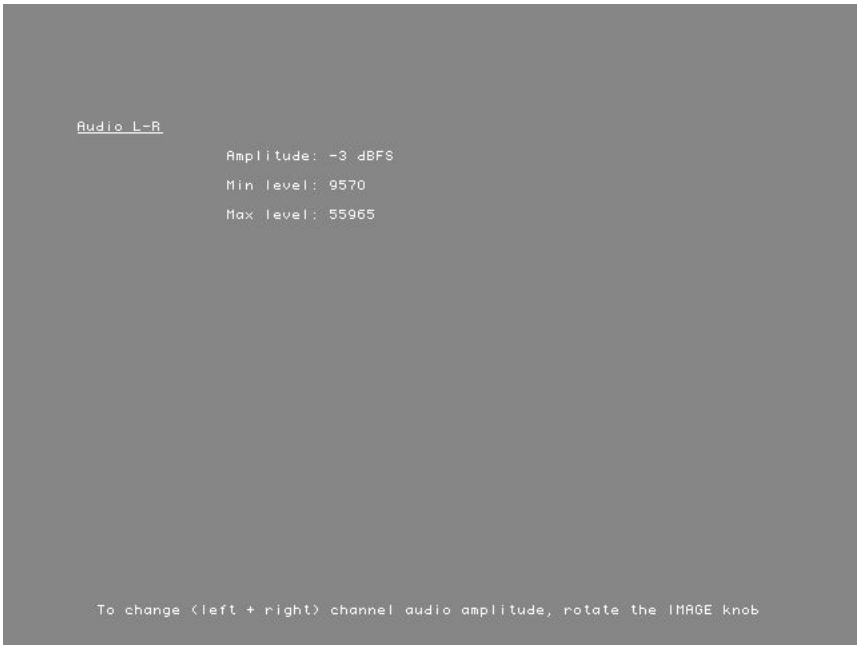
4. Using the **Image** knob, select the appropriate image (see table above).

   The image appears on the connected HDMI display. The image shows the current settings for the HDMI audio output. For example, the AudioLR image is shown below.


Audio L-R
Amplitude: -3 dBFS
Min level: 9570
Max level: 55965
To change (left + right) channel audio amplitude, rotate the IMAGE knob

5. Press and release the **Step** key.

   The **Step** key illuminates.

6. Using the **Image** knob, adjust the amplitude, frequency, or sampling rate (based on the selected image) of the HDMI audio output.

7. To verify proper HDMI audio handling, check the following on the HDMI display:

   - Audio is output from the proper channels (left, right, or both).
   - When amplitude is adjusted, the volume is subsequently changed.
   - When frequency is adjusted, the pitch is subsequently changed.

8. When finished, press and release the **Step** key.

   The light on the **Step** key extinguishes.

9. To test another HDMI audio output type, return to step 4.

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Testing 8-channel HDMI audio output from internal source

To support testing of HDMI audio, the 802 generator provides 8-channel LPCM audio (using an internally-generated sinewave) at the highest audio sampling rate (192 kHz). Multiple scenarios are provided that allow you to test one or both audio channels at different amplitudes and frequencies, as well as test using the different supported sampling rates.

The following table lists the images used to perform HDMI audio testing using an internal audio source.

Image	Description
Audio_1	Channel 1 output with adjustable amplitude.
Audio_1f	Channel 1 output with adjustable frequency.
Audio_2	Channel 2 output with adjustable amplitude.
Audio_2f	Channel 2 output with adjustable frequency.
Audio_3	Channel 3 output with adjustable amplitude.
Audio_3f	Channel 3 output with adjustable frequency.
Audio_4	Channel 4 output with adjustable amplitude.
Audio_4f	Channel 4 output with adjustable frequency.
Audio_5	Channel 5 output with adjustable amplitude.
Audio_5f	Channel 5 output with adjustable frequency.
Audio_6	Channel 6 output with adjustable amplitude.
Audio_6f	Channel 6 output with adjustable frequency.
Audio_7	Channel 7 output with adjustable amplitude.
Audio_7f	Channel 7 output with adjustable frequency.
Audio_8	Channel 8 output with adjustable amplitude.
Audio_8f	Channel 8 output with adjustable frequency.

To test an HDMI display using HDMI 8-channel audio from the generator:

1. Connect an HDMI display to the Tx connector on the generator.
2. If necessary, set up the generator for HDMI output.
   - See “Setting up the generator for HDMI operation” on page 147 for steps on setting up the generator for HDMI operation.
3. Using the **Format** knob, select either the DMT0660 or 480i2x29 format.

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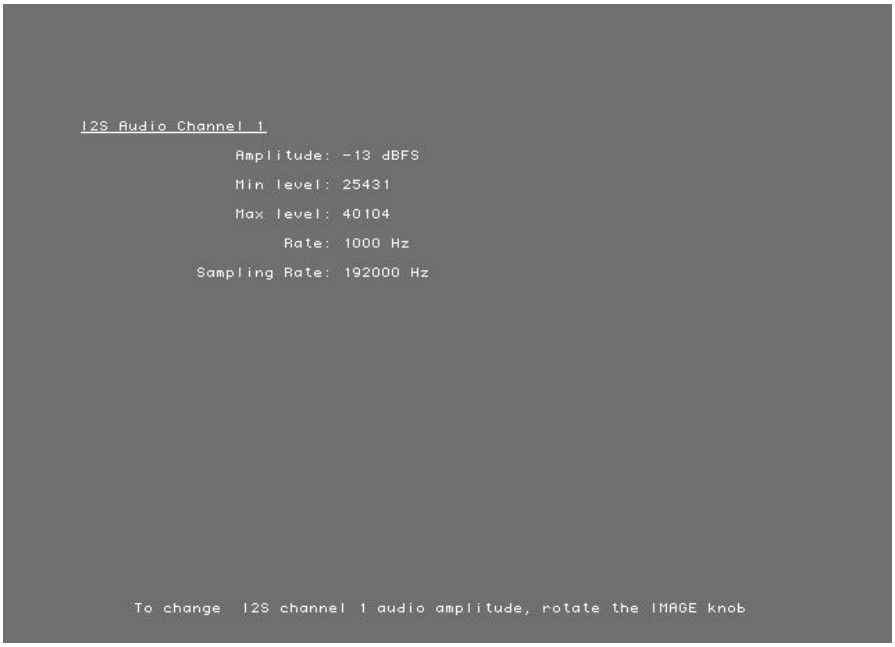
4. Using the **Image** knob, select the appropriate image (see table above).

   The image appears on the connected HDMI display. The image shows the current settings for the HDMI audio output. For example, the Audio_1 image is shown below.


I2S Audio Channel 1
Amplitude: -13 dBFS
Min level: 25431
Max level: 40104
Rate: 1000 Hz
Sampling Rate: 192000 Hz
To change I2S channel 1 audio amplitude, rotate the IMAGE knob

5. Press and release the **Step** key.

   The **Step** key illuminates.

6. Using the **Image** knob, adjust the amplitude or frequency (based on the selected image) of the HDMI audio output.

7. To verify proper HDMI audio handling, check the following on the HDMI display:

   - Audio is output from the proper channels.
   - When amplitude is adjusted, the volume is subsequently changed.
   - When frequency is adjusted, the pitch is subsequently changed.

8. When finished, press and release the **Step** key.

   The light on the **Step** key extinguishes.

9. To test another HDMI audio output type, return to step 4.

Testing HDMI audio using an external audio source

The generator provides basic, two-channel LPCM audio signals. However, it can encode multichannel audio signals from an external SPDIF source (such as a DVD player) with the HDMI content stream.

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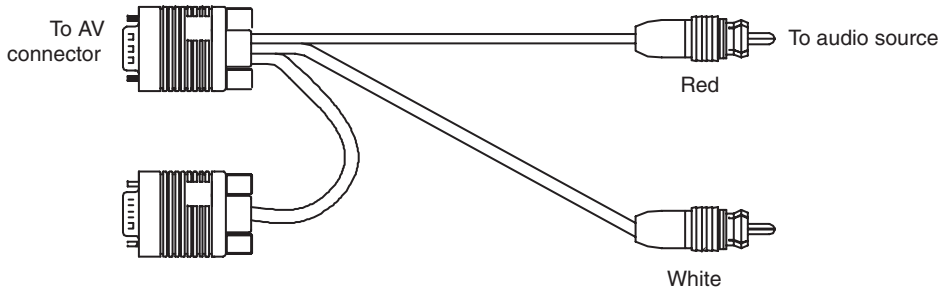
To test an HDMI display using HDMI audio from an external source:

1. Connect an HDMI display to the Tx connector on the generator.
2. Connect the external audio source to the AV connector on the generator using the RCA-to-VGA cable (part 30-00148) provided with the generator, as shown below:



3. If necessary, set up the generator for HDMI output.
   - See "Setting up the generator for HDMI operation" on page 147 for steps on setting up the generator for HDMI operation.
4. Using the **Format** knob, select an appropriate format for the connected HDMI display.
5. Using the **Image** knob, select any desired image.
6. Using a terminal emulator, establish a terminal connection with the generator.
7. Configure the generator to use an external audio source by entering the following command:

   ```
   SDMG 2
   FMTU
   ```

8. Set the sample frequency to match the frequency of the external source by entering the following command:

   ```
   ARAT 44.1E3 (example only)
   ```

   Alternatively configure the generator to detect the audio sampling rate from the channel header of the incoming digital audio.

   ```
   ARAT 0.0
   ```

   Note: *The default frequency is 48 kHz (which is used by DVD players). However, if the external source is an audio CD played on a DVD player, the player will output S/PDIF with a sampling rate of 44.1 KHz (not 48 KHz). In this case, set the sampling frequency to 44.1 kHz (or reload the format, which will detect the sampling frequency automatically).*

9. Turn on the external audio source.

   The external audio signal will be encoded into the HDMI signal.

   Note: *The generator cannot independently control external source channels. You must use the device generating the audio signal to control the channels.*

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10. To verify proper HDMI audio handling, check the following on the HDMI display:
    - Audio is output from the proper channels (left, right, or both).
    - When the volume is adjusted at the external source, the volume is subsequently changed.

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Testing HDMI InfoFrames

This section provides steps on how to test handling of auxiliary (InfoFrame) packets by an HDMI display. The generator loads and sends default Auxiliary Video Information (XAVI), Audio (XAUD), and Source Product Description (XSPD) InfoFrame packet buffers to the display for each format (see table on page 149 for a listing of HDMI formats). The XAVI and the XAUD InfoFrame packets are sent at every frame (repeated mode), while the XSPD is sent only once. The XMPG and XGIF InfoFrames are gated off and not enabled.

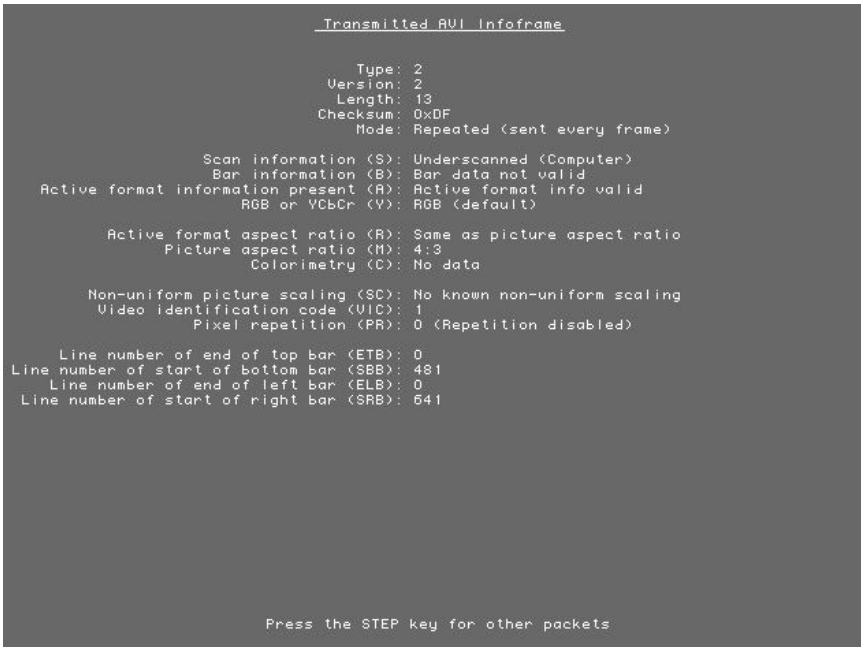
Viewing InfoFrame contents

The 802 generator provides a convenient method for monitoring the InfoFrame content of the transmitted HDMI signal.

To view current HDMI InfoFrame contents transmitted from the generator:

1. Connect an HDMI display to the Tx connector on the generator.
2. If necessary, set up the generator for HDMI output.
   - See “Setting up the generator for HDMI operation” on page 147 for steps on setting up the generator for HDMI operation.
3. Using the **Format** knob, select the HDMI format you want to test.
4. Using the **Image** knob, select the PacketTx image.

   The PacketTx image appears on the connected HDMI display. The image shows the current settings for the AVI InfoFrame output.


Transmitted AVI Infoframe
Type: 2
Version: 2
Length: 13
Checksum: 0xDF
Mode: Repeated (sent every frame)
Scan information (S): Underscanned (Computer)
Bar information (B): Bar data not valid
Active format information present (A): Active format info valid
RGB or YCbCr (Y): RGB (default)
Active format aspect ratio (R): Same as picture aspect ratio
Picture aspect ratio (M): 4:3
Colorimetry (C): No data
Non-uniform picture scaling (SC): No known non-uniform scaling
Video identification code (VIC): 1
Pixel repetition (PR): 0 (Repetition disabled)
Line number of end of top bar (ETB): 0
Line number of start of bottom bar (SBB): 481
Line number of end of left bar (ELB): 0
Line number of start of right bar (SRB): 641
Press the STEP key for other packets

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5. Press and release the **Step** key.

   The **Step** key illuminates.

6. Using the **Image** knob, select the appropriate InfoFrame type.

   The contents of the appropriate InfoFrame output appears on the HDMI display.

7. When finished, press and release the **Step** key.

   The light on the **Step** key extinguishes.

Testing with Active Format Description (AFD)

When transporting HDMI video images from a source to a display, different formats may be used between the content, transmission signal, and display. To provide compatibility between the different formats, Active Format Description (AFD) is used.

AFD describes the portion of the coded video frame that is "of interest" (or “active”). The appropriate AFD information is transmitted with the video to the HDMI display as part of AVI InfoFrame packets. Using AFD information, the display is able to present the image optimally.

For AFD testing, the generator allows you to apply different AFD cases using the AFDtest image, which provides 12 different cases (as image versions) for both 4:3 and 16:9 displays. As each image version appears, the appropriate AFD information is sent with the video to the display.

The following table lists the AFD cases (as specified in the *ETSI TR 101 154 v.1.4.1* standard) that are provided by the generator.

AFD case	Image Version (4:3 Format)	Image Version (16:9 Format)	Aspect Ratio of Active Area
2	8	7	box 16:9 (top)
3	5	4	box 14:9 (top)
4	9-12	9-12	box > 16:9 (center)
8	0	6	Same as the signal format
9	1	1	4:3 (center)
10	7	8	16:9 (center)
11	4	3	14:9 (centered)
13	3	5	4:3 (with shoot and protect 14:9 center)
14	6	2	16:9 (with shoot and protect 14:9 center)
15	2	0	16:9 (with shoot and protect 4:3 center)

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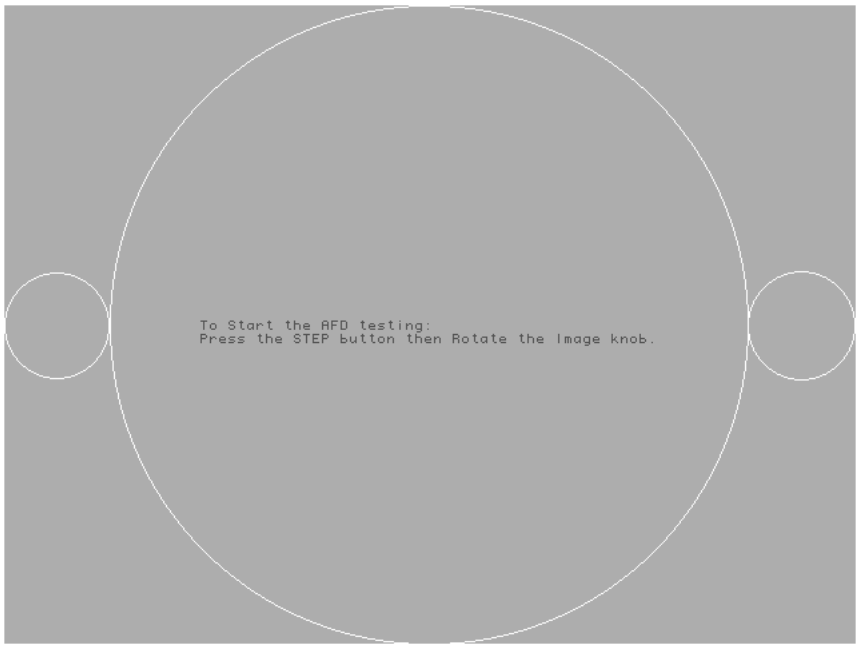
To test an HDMI display's ability to support AFD:

1. Connect an HDMI display to the Tx connector on the generator.
2. If necessary, set up the generator for HDMI output. See "Setting up the generator for HDMI operation" on page 147.
3. Using the **Format** knob, select an appropriate video signal format. See the table on page 149 for a listing of HDMI formats.
4. Using the **Image** knob, select the AFDtest image.

   The AFDtest image appears on the connected HDMI display (as shown below).



5. Press the **Step** key.

   The **Step** key illuminates, and the following image appears.
6. Using the **Image** knob, select an AFD scenario by selecting the appropriate image version number (1-12).

   Note: *The image version number corresponds with the AFD case (or code). See the table on page 162 for a listing of the image numbers that correspond with each AFD case.*

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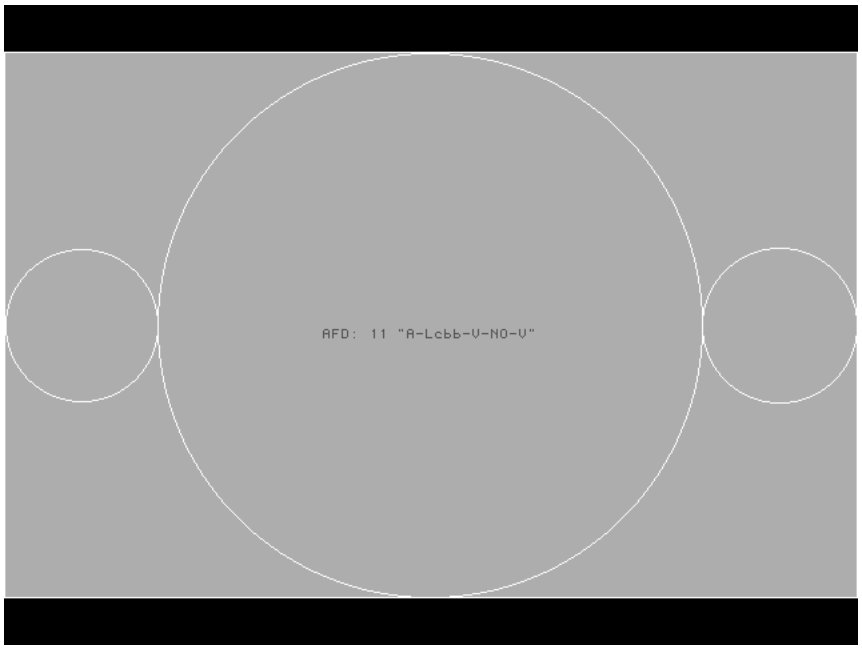
The image appears on the HDMI display. For example, the image representing AFD case 11 (image version 4) on a 4:3 display is shown in the example below.



7. Using the selected AFD scenario, verify that the HDMI display presents the image correctly.

   Note: *Displays use the AFD information to determine how to present an image. Different displays may present HDMI video with the same AFD differently.*

8. Using the **Image** knob, select additional AFD cases (as desired).
9. When finished, press and release the **Step** key.

   The light on the **Step** key extinguishes.

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10 Testing EDID

Topics in this chapter:

- Overview
- EDID testing for source devices
- EDID testing for sink devices

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Overview

This chapter provides procedures for testing EDID generation and handling. The generator can be configured to emulate an HDMI/DVI source when testing HDMI/DVI sink (display) devices or it can be configured to emulate an HDMI/DVI sink (display) device when testing an HDMI/DVI source device.

Some of the EDID tests require the analyzer option. These include testing the EDID handling capabilities of a source device and the HDMI compliance EDID testing for a sink (display) device. Viewing EDID of a display and writing to a display is a generator function and does not require the analyzer option.

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EDID testing for source devices

The generator can emulate an HDMI/DVI sink (display) in order to test HDMI source devices.

Testing response of source to EDID

The analyzer can emulate different HDMI/DVI displays using a built-in, configurable EDID structure. With this capability an HDMI/DVI source device can be tested for its ability to handle an EDID structure received from virtually any DDC-compatible display. You first have to configure the generator to support the HDMI/DVI signal source and enable measuring of internal signals. You then configure the EDID in accordance with a particular display. Use the following procedures.

To set up the generator to perform HDMI/DVI testing:

1. Hold down the **G** and **B** keys, and then power on the generator.

   The following message appears on the front panel LCD.

   ```
   Special:     keys
   Digital friendly
   ```

2. Release the **G** and **B** keys.

   The generator is placed in Digital Friendly mode.

3. Hold down the **R** and **ACS** keys, and then cycle the power to the generator.

   The following message appears on the front panel LCD.

   ```
   Special:     keys
   hot-plug  formats
   ```

4. Hold down the **Step**, **G**, and **B** keys while starting the genertor, until *Status display* appears on the LCD.

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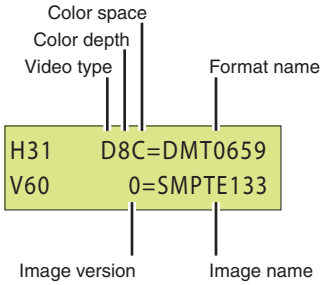
5. Release the **Step**, **G**, and **B** keys to enable status display on the generator (see example below).



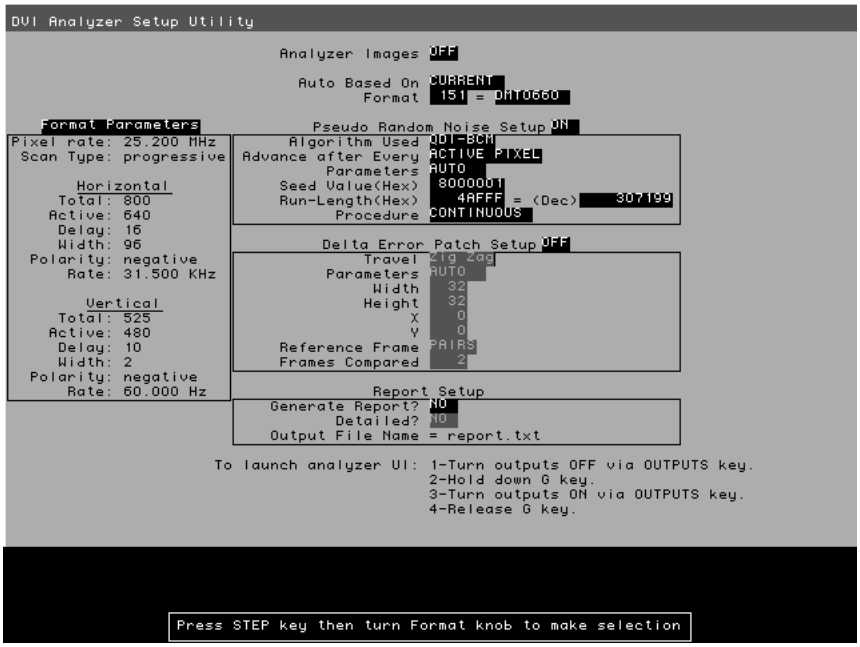
The format status on the LCD will indicate whether the unit is outputting HDMI or DVI signal protocol from the Tx connector. An “H” in the format status (H8C in the example above) indicates HDMI output; a “D” in the format status indicates DVI output.

Note: *With the compliant Hot-plug Formats mode active and a hot-plug detected, the generator automatically selects the appropriate TMDS output signal protocol (HDMI or DVI) for the attached display (via EDID read).*

To configure the analyzer for internal measurements:

1. Connect a digital display with the DVI or HDMI transmitter on the generator.
2. Select the Analzyer image.

   The Analyzer Setup Utility appears on the connected display.



3. Press and release the **Step** key.

   The **Step** key illuminates and the **Analyzer Images** field is highlighted.

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4. Using the **Image** knob, select the ON setting to enable analyzer images.
5. Using the **Format** knob, select the **Auto Based On** field.
6. Using the **Image** knob, select CURRENT in the highlighted field to measure the HDMI/DVI signal originating *internally* from the generator.
7. Press and release the **Step** key to save the currently displayed parameters.

   The light on the **Step** key extinguishes, and the new settings are implemented for analyzer mode operation.

To configure the analyzer to emulate the EDID structure of a display:

1. Determine the HDMI/DVI display you wish to emulate and if possible obtain a text file of its EDID.

   Note: *This can be obtained from the manufacturer or by reading the EDID using the HDMI/DVI generator. For procedures on reading the EDID of a display with the generator, please refer to "Viewing EDID from a display" on page 171.*

2. Connect an HDMI/DVI cable between the HDMI/DVI Tx and Rx connectors on the generator.
3. Using a terminal emulator, establish a terminal session with the generator (see page 14).
4. Modify the EDID structure in the generator using the XDID and DIDU commands.

   For example, to change the color characteristics of the EDID structure (a total of 10 bytes starting at byte 19), you could use the following command strings:

   ```
   XDID 19 A E88A82A0564796240F48
   DIDU
   ```

   To program multiple segments (or the entire EDID structure) at once, create a text file containing the EDID. Then send the text file to the generator using your terminal emulator's file transfer feature.

   The following commands write the entire EDID block 0:

   ```
   XDID 0 80 00FFFFFFFFFFFF005A63118F01010101130D010380221B782A4706A55C47
   9C251E4F54BFEF008180310A01010101010101010101010101302A009851002A40307013
   00520E1100001E000000FF00413233303331393135333539 0A000000FD00324B1E530E
   000A20202020202000000FC0056583730302D330A20202020200095
   DIDU
   ```

5. To verify the EDID structure, use the EDID? query. This command will display the entire EDID structure in ASCII hex format.

   To view a specific segment of EDID, use the I2CR? query. This command will display the requested EDID in ASCII hex format.

6. If desired, use the STRG command to stretch the SCL low signal for 5 ms in the analyzer's receiver.

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To test the source device's handling of the EDID:

1. Connect the HDMI/DVI source device to the HDMI/DVI Rx connector on the generator.

   Upon receiving the HDMI/DVI signal at the HDMI/DVI Rx connector, the generator sends the EDID structure to the source device.

2. At the HDMI/DVI source device, compare the processed EDID information with the EDID structure defined in the generator.

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EDID testing for sink devices

The generator can emulate an HDMI, DVI or VGA source device in order to test HDMI, DVI or VGA displays. This includes viewing EDID from a display and writing EDID data to a display. The generator can test an HDMI display device's EDID structure and transmission in accordance with the HDMI Compliance Test Specification 1.0.

Viewing EDID from a display

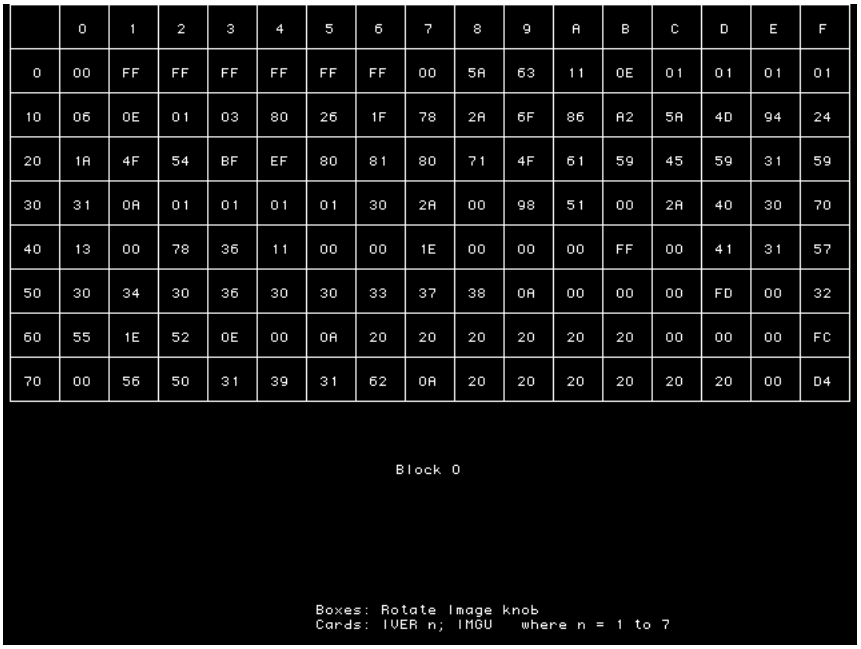
You can use the generator to view EDID from a DDC-compliant VGA, HDMI or DVI display connected with the generator.

To view EDID information from an HDMI, DVI or VGA display:

1. Connect an HDMI, DVI or VGA device to the HDMI, DVI or VGA Tx connector on the generator.
2. Using the Format knob, select an appropriate format for the HDMI, DVI or VGA display connected to the HDMI, DVI or VGA Tx connector.

   Alternatively, to automatically configure the Format knob list based on the EDID of the display, hold down the **R** key, and then press and release the **ACS** key.
3. Using the **Image** knob, select the EdidData image.

   The EdidData image displays the first block of data.
4. Press the **Step** key, turn the **Image** knob to the first EDID block.



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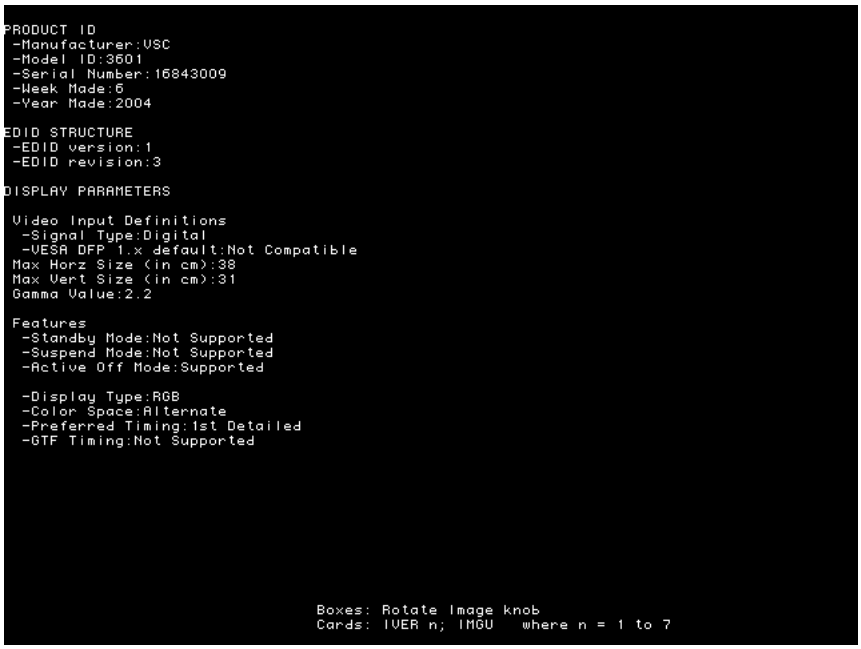
5. To view parsed EDID information, press and release the **Step** key, and then turn the **Image** knob to view additional blocks and parsed data.



To query EDID information from an HDMI, DVI or VGA display via the command line:

1. Using a terminal emulator, establish a terminal session with the generator (see page 14).
2. To view the current EDID in ASCII hex format, use the EDID? command.

   To view a specific segment of EDID, use the I2CR? command.

   Querying the EDID from the command line enables you to create a text file with the EDID in order to configure the analyzer to emulate the display device.

Writing EDID data to a display

You can modify the EDID in the connected display, if the EEPROM in the display is writable.

To modify the EDID in a display:

1. Connect the display to be modified to the HDMI, DVI or VGA Tx connector on the generator.
2. Using a terminal emulator, establish a terminal session with the generator (see page 14).

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3. Use the I2CW command to modify the EDID structure in the connected display.

   For example, to change the color characteristics of the EDID structure (a total of 10 bytes starting at byte 19), you could use the following command string:

   ```
   i2cw eprom1 a0 25 A E88A82A0564796240F48
   ```

4. To program multiple segments or a complete EDID structure, use a text editor to enter the commands in a text file, and then download the file to the generator from a terminal emulator program such as HyperTerminal.

Testing EDID in HDMI sink device for HDMI compliance

The analyzer supports the following EDID and video HDMI compliance tests in accordance with the HDMI Compliance Test Specification 1.0 (CTS):

- Test ID 8-1: EDID Readable
- Test ID 8-2: EDID VESA Structure
- Test ID 8-3: CEA Timing Extension Structure
- Test ID 8-17: 861B Format Support Requirements
- Test ID 8-18: HDMI Format Support Requirements
- Test ID 8-19: Pixel Encoding Requirements
- Test ID 8-20: Video Format Timing

These tests are intended for in-house testing of products before submission to an HDMI ATC for full certification testing.

Overview of HDMI compliance testing

HDMI compliance testing is conducted through the generator's transmit HDMI connector. A standard HDMI-to-HDMI cable is used between the device under test and the generator. The generator must be placed in the digital friendly mode and set to output HDMI signals, which is the default configuration for HDMI equipped generators.

After making the physical connections you need to specify the capabilities of the sink display under test. This enables the generator to compare the expected results with the actual results measured from the display. Use the CDF_Sink image, which is based on the Capabilities Declaration Form (Appendix 3) of the Compliance Test Specification, to specify the display capabilities.

To test the sink device, load the EdidHDMI image, and turn the image knob to advance through each test listed above in sequence.

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Testing HDMI sink devices for EDID compliance

The procedures for EDID and video testing of HDMI sink devices in accordance with the HDMI Compliance Test Specification 1.0 are provided below.

Note: *The EDID and video tests should be performed in sequence as a single test series. Each test is dependent on successful completion of the previous test.*

To set up the generator for HDMI compliance testing:

1. Hold down the **G** and **B** keys, and then power on the generator.

   The following message appears on the front panel LCD.

   ```
   Special:     keys
   Digital friendly
   ```

2. Release the **G** and **B** keys.

   The generator is placed in Digital Friendly mode.

3. Select and apply a valid HDMI format such as DMT0660 either by turning the Format knob or entering the following command:

   ```
   FMTL DMT0660; FMTU
   ```

4. Load the GenOps image to verify that the generator is configured to output HDMI (that it is not in DVI-only mode).

   The generator's default configuration is to output HDMI. Note that the display status mode will indicate that the generator is in HDMI mode with an "H" character. You can also verify that the generator is putting out an HDMI signal by issuing the following command:

   ```
   HDMI?
   ```

   The returned value should be 1 indicating HDMI output.

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To specify the capabilities of the sink device:

1. Load the CDF_Sink image, which is shown below.

2. Press and release the Step key to enable selection of each field. Use the Format knob to position the cursor. Use the Image knob to choose values.

   For example, if your display supports both 4:3 and 16:9 aspect ratios, set the Sink_PrimaryAR field to *Both*.

3. Press the Step (Exit) key to save the settings. The settings are stored until you change them, and are kept if the generator is restarted.

To initiate the compliance testing:

1. Load the EdidHDMI image.
2. Press and release the STEP key, then turn the Image knob to progress through the tests in the sequence below.

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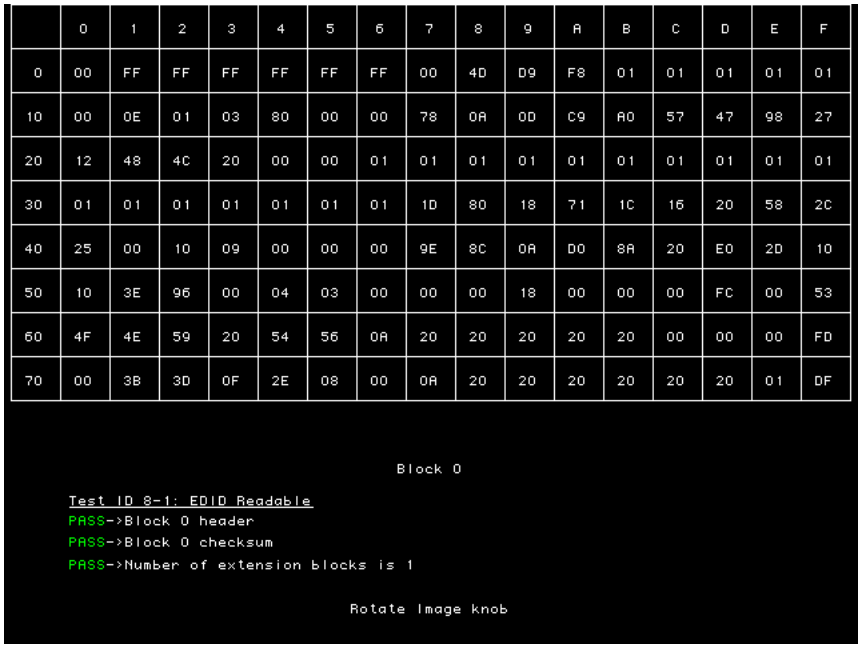
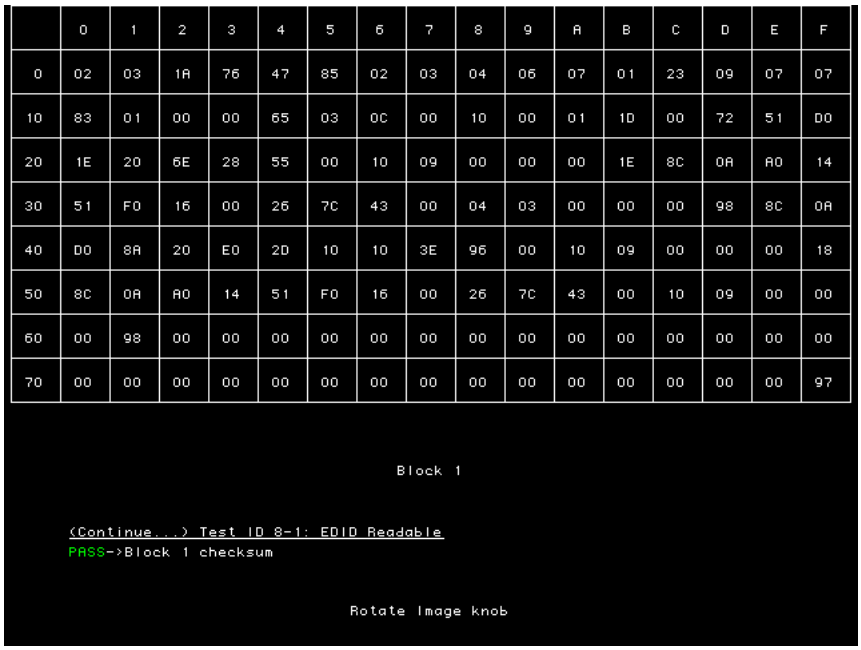
Testing EDID readability (Test ID 8-1) - This test verifies that the EDID can be read properly. The screens are shown below.



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	00	FF	FF	FF	FF	FF	FF	00	4D	D9	F8	01	01	01	01	01
10	00	0E	01	03	80	00	00	78	0A	0D	C9	A0	57	47	98	27
20	12	48	4C	20	00	00	01	01	01	01	01	01	01	01	01	01
30	01	01	01	01	01	01	01	1D	80	18	71	1C	16	20	58	2C
40	25	00	10	09	00	00	00	9E	8C	0A	D0	8A	20	E0	2D	10
50	10	3E	96	00	04	03	00	00	00	18	00	00	00	FC	00	53
60	4F	4E	59	20	54	56	0A	20	20	20	20	20	00	00	00	FD
70	00	3B	3D	0F	2E	08	00	0A	20	20	20	20	20	20	01	DF



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	02	03	1A	76	47	85	02	03	04	06	07	01	23	09	07	07
10	83	01	00	00	65	03	0C	00	10	00	01	1D	00	72	51	D0
20	1E	20	6E	28	55	00	10	09	00	00	00	1E	8C	0A	A0	14
30	51	F0	16	00	26	7C	43	00	04	03	00	00	00	98	8C	0A
40	D0	8A	20	E0	2D	10	10	3E	96	00	10	09	00	00	00	18
50	8C	0A	A0	14	51	F0	16	00	26	7C	43	00	10	09	00	00
60	00	98	00	00	00	00	00	00	00	00	00	00	00	00	00	00
70	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	97

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Testing EDID VESA structure (Test ID 8-2) - This test verifies that the data in the base EDID 1.3 block and basic EDID Extension handling is correct and meets all aspects of the relevant specifications.

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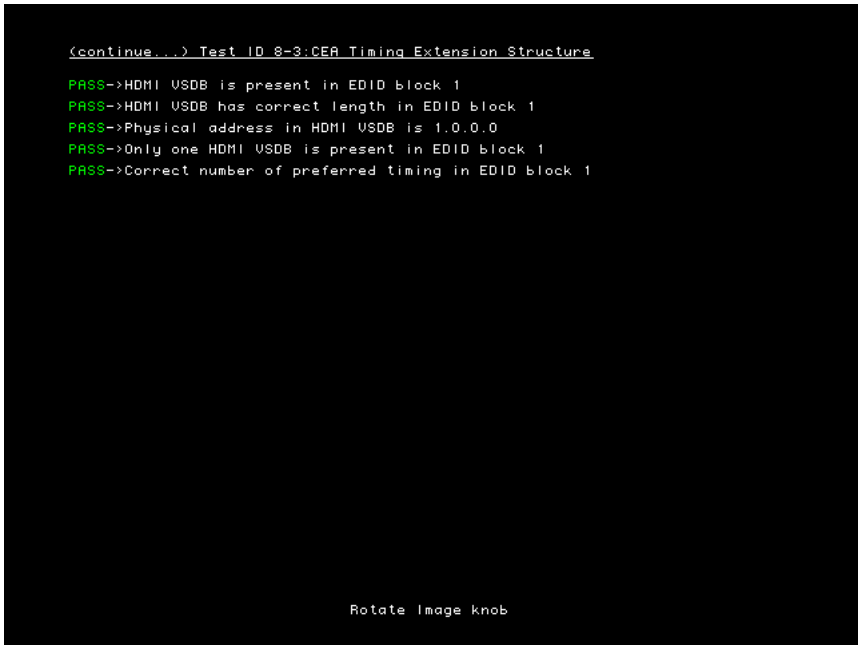
Testing CEA timing extension structure (Test ID 8-3) - This test verifies that the data in any CEA Timing Extension present in EDID is formatted properly and meets all aspects of the relevant specifications.

Test ID 8-3:CEA Timing Extension Structure
PASS->CEA T.E. in EDID block 1
PASS->Correct CEA T.E. version in EDID block 1
PASS->Legal Data Block types in EDID block 1
PASS->Basic Audio and Audio Data Block are found in EDID block 1
PASS->Audio Block length is a multiple of 3 in EDID block 1
PASS->Short Audio Descr. Rsvd bits are zeros in EDID block 1
PASS->Short Audio Descr. Rsvd byte is zero in EDID block 1
PASS->One Speaker Alloc. Data Block is present in EDID block 1
PASS->Legal Speaker Alloc Block length in EDID block 1
PASS->Speaker Alloc Descr. Rsvd bits zero in EDID block 1
PASS->Speaker Alloc rsvd bytes zeros in EDID block 1
PASS->d points to correct location in EDID block 1
PASS->Zero value in padding DTD in EDID block 1
Rotate Image knob


(continue...) Test ID 8-3:CEA Timing Extension Structure
PASS->HDMI VSDB is present in EDID block 1
PASS->HDMI VSDB has correct length in EDID block 1
PASS->Physical address in HDMI VSDB is 1.0.0.0
PASS->Only one HDMI VSDB is present in EDID block 1
PASS->Correct number of preferred timing in EDID block 1
Rotate Image knob

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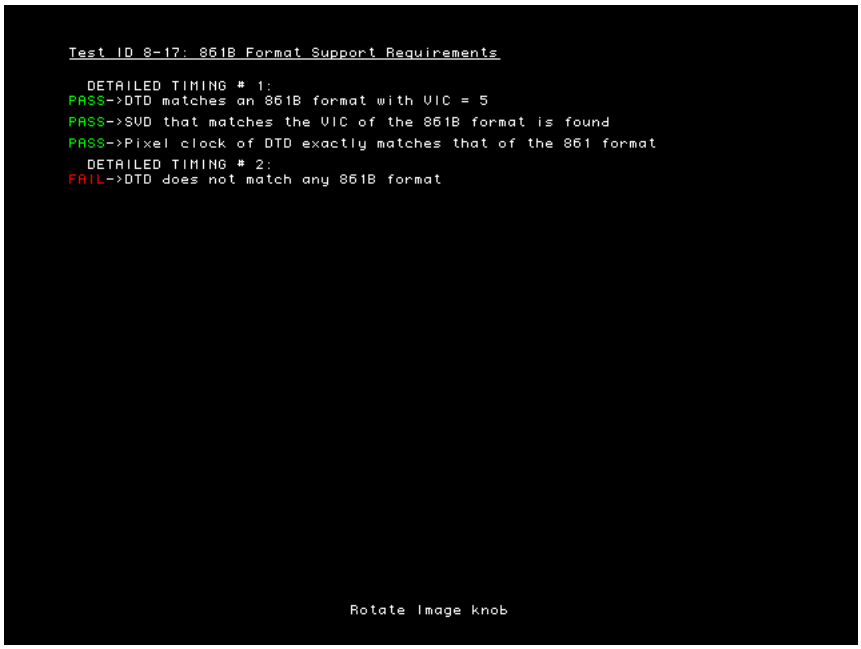
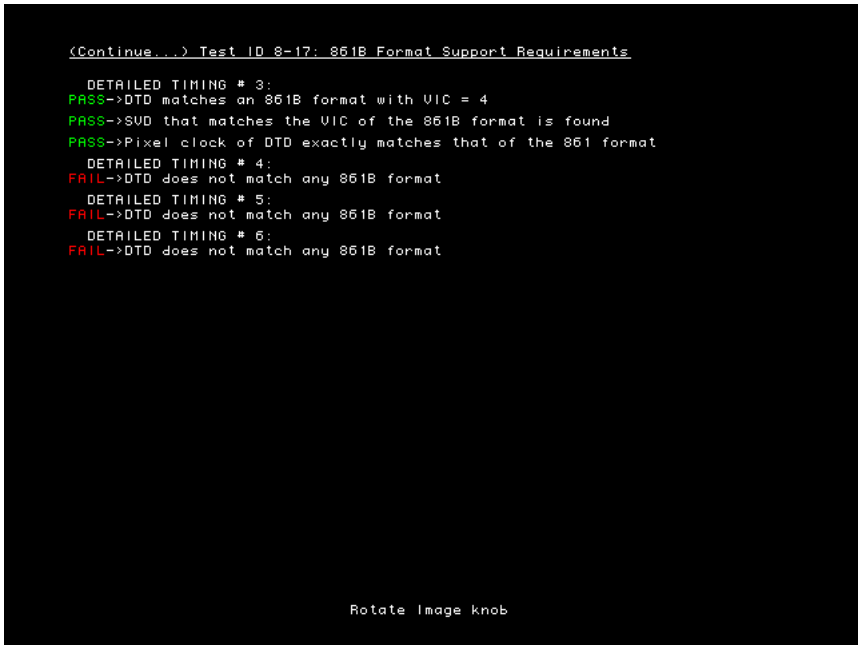
Testing 861B Format Support Requirements (Test ID 8-17) - This test verifies that no 861B-defined video format is declared only in a Detailed Timing Descriptor.


Test ID 8-17: 861B Format Support Requirements
DETAILED TIMING # 1:
PASS->DTD matches an 861B format with VIC = 5
PASS->SVD that matches the VIC of the 861B format is found
PASS->Pixel clock of DTD exactly matches that of the 861 format
DETAILED TIMING # 2:
FAIL->DTD does not match any 861B format
Rotate Image knob


(Continue...) Test ID 8-17: 861B Format Support Requirements
DETAILED TIMING # 3:
PASS->DTD matches an 861B format with VIC = 4
PASS->SVD that matches the VIC of the 861B format is found
PASS->Pixel clock of DTD exactly matches that of the 861 format
DETAILED TIMING # 4:
FAIL->DTD does not match any 861B format
DETAILED TIMING # 5:
FAIL->DTD does not match any 861B format
DETAILED TIMING # 6:
FAIL->DTD does not match any 861B format
Rotate Image knob

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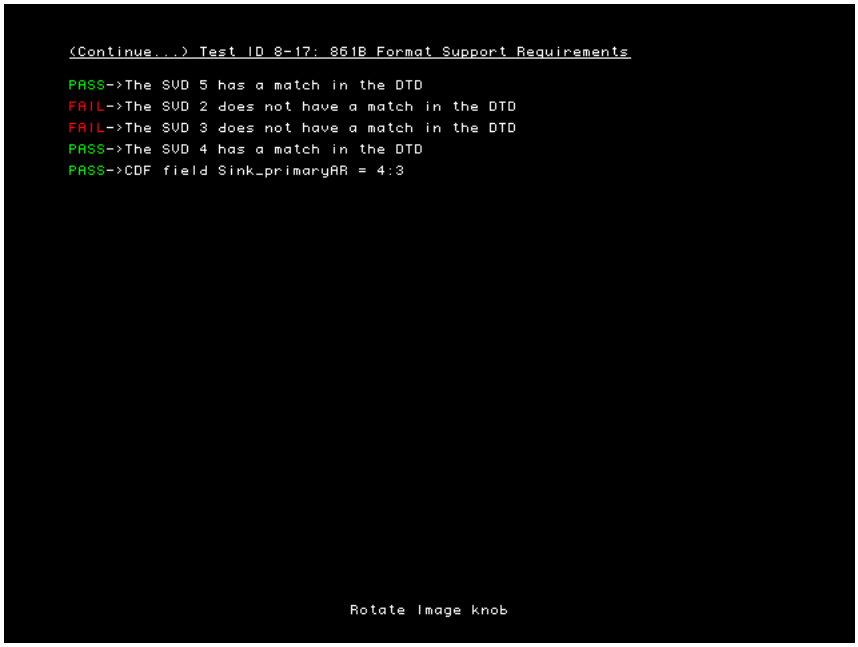
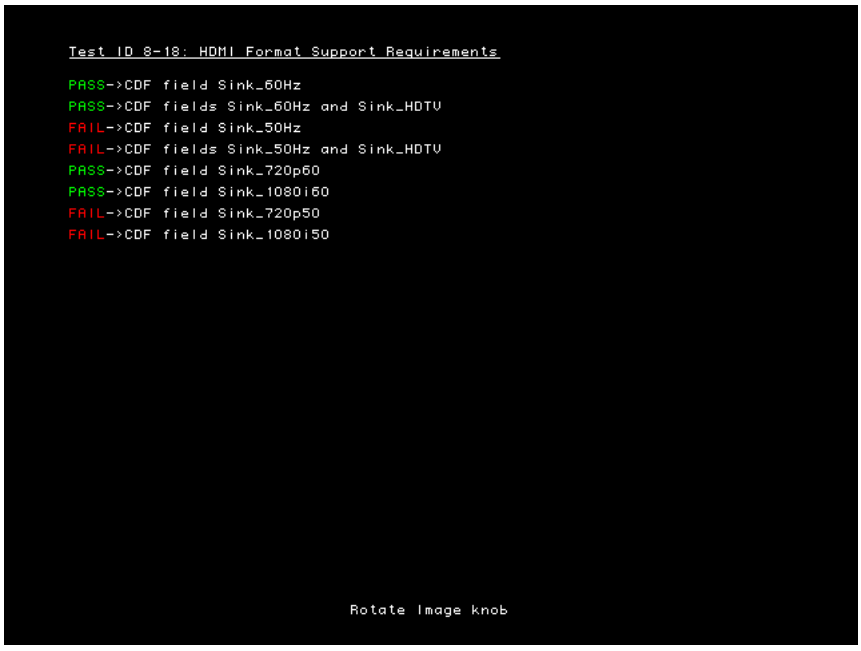

(Continue...) Test ID 8-17: 861B Format Support Requirements
PASS->The SVD 5 has a match in the DTD
FAIL->The SVD 2 does not have a match in the DTD
FAIL->The SVD 3 does not have a match in the DTD
PASS->The SVD 4 has a match in the DTD
PASS->CDF field Sink_primaryAR = 4:3
Rotate Image knob

Testing HDMI Format Support Requirements (Test ID 8-18) - This test verifies that Sink DUT indicates support for all required video formats in its EDID.



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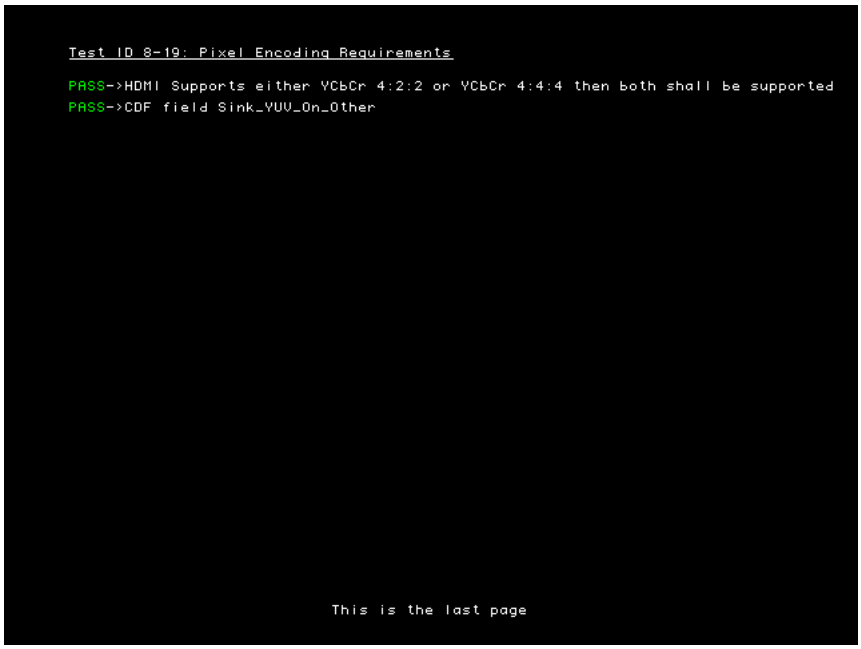
Testing Pixel Encoding Requirements (Test ID 8-19) - Verifies that the Sink supports YCpCr pixel encoding when required.


Test ID 8-19: Pixel Encoding Requirements
PASS->HDMI Supports either YCbCr 4:2:2 or YCbCr 4:4:4 then both shall be supported
PASS->CDF field Sink_YUV_On_Other
This is the last page

To create a knob list of all formats supported by the display:

1. Press and release the STEP key to return to the initial compliance testing screen.

   The STEP key should be extinguished.

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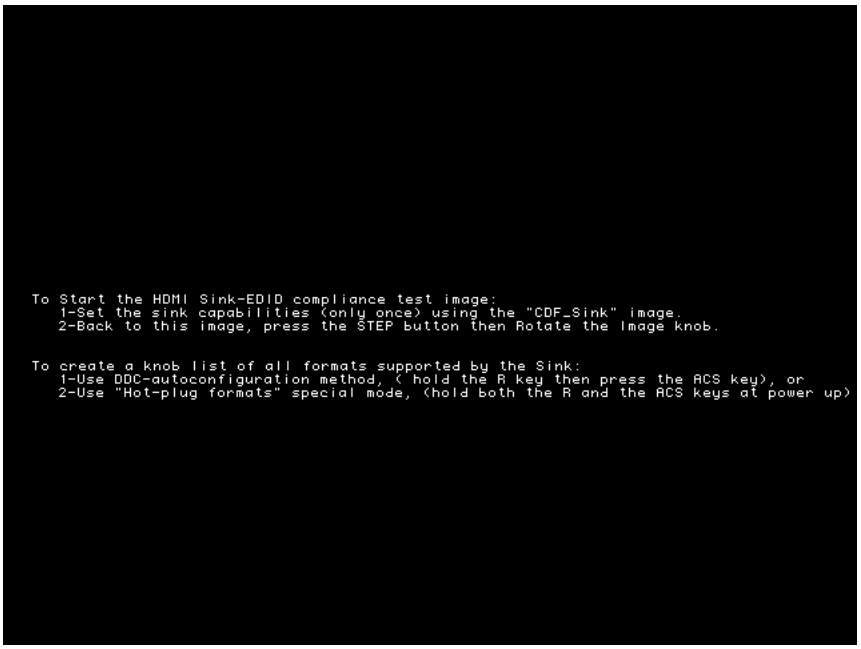
2. Press and hold the R key and then press and release the ACS key. Alternatively power off the generator, press and hold both the R and ACS keys then power up the generator to configure the generator knob list with the hot plug formats.

   The initial compliance test screen re-appears and the Format knob list includes only those formats in the display EDID.


To Start the HDMI Sink-EDID compliance test image:
1-Set the sink capabilities (only once) using the "CDF_Sink" image.
2-Back to this image, press the STEP button then Rotate the Image knob.
To create a knob list of all formats supported by the Sink:
1-Use DDC-autoconfiguration method, (hold the R key then press the ACS key), or
2-Use "Hot-plug formats" special mode, (hold both the R and the ACS keys at power up)

Visual verification of formats

Additional visual inspection of Tests 8-19 and 8-20 is necessary to ensure that each format can be loaded and displayed at each pixel encoding and at its minimum and maximum pixel rate.

Test ID 8-19 involves testing each format with different YCbCr pixel encoding: 4:4:4 pixel sampling and 4:2:2 sampling. Test ID 8-20 requires that each format listed in the EDID be be tested at two different pixel clock frequencies. The two different frequencies shall be the minimum and maximum permitted by a Source. For 50Hz formats, these values are 49.75Hz and 50.25Hz (50Hz ± 0.5%). For 59.94Hz or 60Hz formats, these frequencies are 59.64Hz (59.94Hz – 0.5%) and 60.3Hz (60Hz + 0.5%). The tested pixel clock frequency accuracy shall be ±0.05%.

A separate listing of the formats is provided on the Format knob list to support this visual inspection testing. The nomenclature for visual inspection testing of maximum and minimum pixel rate is of the form shown in the example below:

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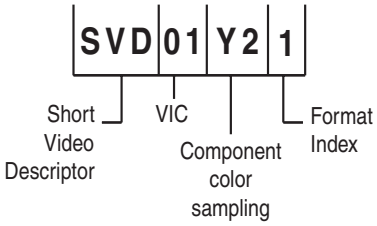
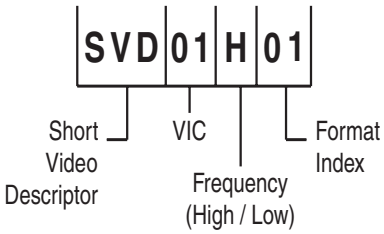
Example



- **SVD** – Short Video Descriptor.
- **01** – EIA/CEA-861-B Format Video Identification Code (for example 01, 02, 06, etc. listed on page 149)
- **Y2** – Y indicates color difference. 2 = 4:2:2 pixel sample encoding. 4 = 4:4:4.
- **1** – Represents DMT0659 format, which is first format (index 1) listed under video identification code 01 in table on page 149.

The nomenclature for visual inspection testing for pixel encoding is of the form shown in the example below:



- **SVD** – Short Video Descriptor.
- **01** – EIA/CEA-861-B Format Video Identification Code (for example 01, 02, 06, etc. listed on page 149)
- **H** – Indicates that format is using maximum (H = High) or minimum (L = Low) frequency required by compliance test.
- **01** – Index of format as listed under video identification code onpage 149.

To visually validate the formats in the knob list for pixel encodings and pixel rate:

1. Select an image suitable for testing the display type by turning the Image knob or entering the appropriate command. For example to display the Master image enter:

   ```
   IMGL Master; IMGU
   ```

2. Turn the format knob to display each of the formats in the knob list that begin with SVD.

   Each format should display properly.

3. Turn the format knob to display each of the formats in the knob list.

   Each format should display properly.

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11 Testing HDCP

You can use the generator, with the High-bandwidth Digital Content Protection (HDCP) option installed, to test HDCP 1.0 and 1.1 compliant devices.

For more information about HDCP, see http://www.digital-cp.com/.

Topics in this chapter:

- Testing DVI or HDMI receiver with HDCP
- Testing HDCP between HDMI transmitter and DVI receiver
- Testing HDCP with static images
- Using command-line interface to control HDCP
- Troubleshooting HDCP errors

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Testing DVI or HDMI receiver with HDCP

This section describes how to test DVI and HDMI receivers with HDCP.

All DVI and HDMI options, including analyzer options, support HDCP production keys if the HDCP option is installed. Some DVI options support both production and public keys.

To determine which HDCP keys your generator supports:

1. Load the GenStats image.
2. Verify that *HDCP* is listed under the Options heading, which indicates that the HDCP option is installed, and that production keys are available.
3. If the following image names are listed on the LCD, then HDCP public (test) keys are installed.
   - HdcpA1B1
   - HdcpA1B2
   - HdcpA2B1
   - HdcpA2B2

   Note: *With older firmware installed, you may be able to select these images, but an "Image is not available" message is displayed on the display connected with the generator. This message indicates that public keys are not installed.*

To test HDCP with a DVI device:

1. Hold down the **G** and **B** key while starting the generator put the generator in digital friendly mode.

   Alternatively, enter the following command:

   ```
   SROP 2
   ```
2. Connect the DVI transmitter on the generator to the device's DVI receiver.
3. Select an appropriate HDCP test image.

   If you are testing a device with a production key, select the HdcpProd(uction) image. The HdcpProd image assumes that both the HDCP transmitter and receiver have a production key.

   If your generator supports public keys, select the appropriate image below. For example, if the receiver has pubic key B2, and you want to use public key A1 in the transmitter, then select the HdcpA1B2 image.
   - HdcpA1B1
   - HdcpA1B2
   - HdcpA2B1

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- HdcpA2B

STEP 1: Reset the transmitter - PASS
STEP 2: Initialize the transmitter - PASS
STEP 3: At transmitter generate An - PASS
STEP 4: Write An to the receiver - PASS
STEP 5: Write the transmitter KSV to the receiver - PASS, Aksv = 0x91584AD36F
STEP 6: Read and verify the receiver KSV - PASS, Bksv = 0x9C116E35EA
STEP 7: Write receiver KSV to transmitter - PASS
STEP 8: Ri ready at transmitter - PASS
STEP 9: Read and compare transmitter Ri with receiver Ri - PASS
RiTX = 0xA543
RiRX = 0xA543
STEP 10: Generate authentication - PASS
STEP 11: Transmitting encrypted data - TESTING
HDCP test passed as long as you can read this.
RiTX = 0x73C7
RiRX = 0x73C7
PASS
4

The image will indicate if the test passed or failed. If the test fails, see “Troubleshooting HDCP errors” on page 191.

4. To test another device, connect the cable to the new device.

   The HDCP test starts automatically.

To test HDCP with an HDMI device:

1. Hold down the **G** and **B** key while starting the generator put the generator in digital friendly mode.

   Alternatively, enter the following command:

   ```
   SROP 2
   ```

2. Connect the HDMI transmitter on the generator to the device’s HDMI receiver.
3. Select the HdcpProd(uction) image.

   The image will indicate if the test passed or failed. If the test fails, see “Troubleshooting HDCP errors” on page 191.

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Testing HDCP between HDMI transmitter and DVI receiver

HDCP 1.1-compliant devices must interoperate with HDCP 1.0 compliant devices using the DVI protocol. Generators with an HDMI transmitter can be used to test HDCP with devices that have an DVI receiver.

To test HDMI Tx with DVI Rx:

1. Hold down the **G** and **B** key while starting the generator put the generator in digital friendly mode.

   Alternatively, enter the following command:

   ```
   SROP 2
   ```

2. Establish a command terminal connection with the generator, using HyperTerminal or VGM.
3. At the R:> prompt, enter the following to set the HDMI transmitter into DVI mode, which disables audio:

   ```
   HDMI 0
   ALLU
   ```

   The DVI mode setting is saved until you change it.

4. Use an HDMI-to-DVI cable (provided with HDMI generator) to connect the HDMI transmitter to the DVI receiver.
5. Load the HdcpProd image. This image assumes that both the transmitter and receiver are using production keys.

   The image will indicate if the test passed or failed. If the test fails, see “Troubleshooting HDCP errors” on page 191.

To change HDMI transmitter from DVI to HDMI mode:

1. Establish a command terminal connection with the generator, using HyperTerminal or VGM.
2. At the R:> prompt enter the following to invoke the HDMI mode:

   ```
   HDMI 1
   ALLU
   ```


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Testing HDCP with static images

The standard HDCP test images have color bars in the background. A special mode is available for testing HDCP with any static background image you specify.

To test HDCP with a different background image:

1. Turn on the generator while holding down the **G** and **ACS** keys until *hdcp tester* is displayed.

   Alternatively, enter the following command:

   ```
   SROP 8192
   ```

2. Select a format that is supported by the display, and then load any static image.

   The HDCP test begins automatically when you connect the display.

   If the HDCP test passed, the generator displays the image you specified. If the test failed, the display will remain blank. See “Troubleshooting HDCP errors” on page 191.

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Using command-line interface to control HDCP

The command interface can control HDCP tests in automated testing environments.

To run HDCP test from command prompt:

1. Establish a command terminal connection with the generator using VGM or HyperTerminal.
2. Connect the device to be tested to the transmitter on the generator.
3. At the R:> prompt, enter the following command to run the HDCP test:

   ```
   HDCP?
   ```

HDCP? command

The HDCP? command is the only command used to control HDCP tests.

Syntax HDCP? [A1 | A2] [B1 | B2] [*frames*]

Where *frames* is the number of frames to be tested. The default number of frames is 512.

Example These examples demonstrate how to specify which test to run.

Command	Result
hdcp?	Runs test with production keys for 512 (default) frames, and then returns 0 if the test passed, or an error number if the test failed.
hdcp? 2000	Run test with production keys for 2000 frames.
hdcp? a1 b1	Runs test with public keys A1 and B1 for 512 frames.
hdcp? a2 b1 2000	Runs test with public keys A2 and B1 for 2000 frames.

Error codes These errors may occur when using the HDCP? command.

Code	Meaning
9520	HDCP key combination is not supported. Valid combinations are A1/B1, A2/B1, A1/B2, and A1/B2.
9521	Test started successfully, but failed during test.
9522	Test did not start.
9508	Specified keys are not present.

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Troubleshooting HDCP errors

Common problems

This table describes possible solutions to problems that may occur during HDCP testing.

Problem	Solution
Test fails at step 3	Transmitter could not read Bksv from the receiver, Bksv was read correctly but is a wrong value, or an I2C error occurred. If the EdidData image loads, the I2C communication is working properly. Verify that the Bksv value is 5 bytes (that is, 40 bits of which 20 zeros and 20 ones) by reading the value from the test image.
HdcpProd image flashes repeatedly at step 9	Restart the generator while holding down the Outputs key, or use the SROP 16 command, which starts the generator in “Reset HDCP Rx by gating clock” mode.
HdcpProd image is unavailable	The HdcpProd image requires the HDCP production key option to be installed in the generator. To determine if this option is installed, view the GenStats image. The HDCP option will be listed under the Options heading if it is present.

Running HDCP test in step mode

The generator normally runs the steps in the HDCP test automatically. If the test fails, the test is restarted after a few seconds, which makes it difficult to read values at the step where the test failed. Run any HDCP test in manual mode to pause the test after each step.

To run the HDCP test in step mode:

1. At any step during an HDCP test, press the **Step** key.
2. Turn the **Image** knob to advance to the next step. If you are using an PCI-based generator, use the commands displayed on the screen to advance to the next step.
3. Press the **Step** key again to return to automatic mode.

Running an HDCP self-test

An HDCP self-test checks that HDCP authentication is working properly between the transmitter and receiver on the analyzer. This test can also be used to confirm that a cable is not interfering with HDCP authentication, and that the DDC clock and DDC data pins, which the I2C buss uses, are working correctly.

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To run an HDCP self-test:

1. Hold down the **G** and **B** key while starting the generator put the generator in digital friendly mode.

   Alternatively, enter the following command:

   ```
   SROP 2
   ```

2. Connect your cable to the Rx and Tx on the analyzer.
3. Select the HdcpProd image.

   When testing a display, the HDCP test results are displayed on the display being tested. When testing a cable, where no display is connected to the transmitter, test results are displayed by the LCD display on the generator. If HDCP authentication is working correctly, the name of the HdcpProd image on the LCD will be updated with Ri values every 2 seconds. If HDCP is not working, the LDC display will remain static.

Understanding the HDCP test

Understanding what the generator does during an HDCP test can help you determine why an HDCP test failed.

To determine which hardware is installed:

1. Load the GenStats image.
2. Compare the following table with the GenStats image to determine which hardware is installed.

GenStats information	Hardware
DVI (Sil) (under Options) and DVI FPGA less than F1 (under Generator Information)	Silicon Image
DVI (under Options)	Broadcom
DVI Analyzer (under Options)	Silicon Image
DVI II (under Options) and DVI FPGA F1 or later (under Generator Information)	Silicon Image
DVI II (under Options) and DVI FPGA is earlier than F1 (under Generator Information)	Broadcom
HDMI (under Options)	Silicon Image
HDMI Analyzer (under Options)	Silicon Image

Test sequence for Broadcom transmitters:

1. The generator resets the transmitter and its HDCP engine.

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2. If the “Reset HDCP Rx by gating clock” mode is enabled, the generator resets the receiver, and gates off transmitter clock and data for 400 mS. Otherwise, the receiver is not reset.
3. The transmitter reads the Bksv (HDCP receiver KSV), over the I2C bus, and verifies that it has 20 zeros and 20 ones.

   This step is the first interaction between the transmitter and receiver.
4. Receiver writes the receiver KSV to the transmitter.
5. Transmitter generates An (session random number).
6. Transmitter writes An to the receiver, using the I2C bus.
7. Transmitter writes the transmitter KSV to the receiver, using the I2C bus.
8. Load the transmitter keys.
9. The transmitter reads the Ri value (link verification response) from the receiver and compares it with its own generated Ri value. They should match to proceed. If this step fails, the test returns to step 1.
10. Generate authentication.
11. Transmitting encrypted data.

Test sequence for Silicon Image transmitters:

1. Reset the transmitter.
2. If the “Reset HDCP Rx by gating clock” mode is enabled, the generator initializes the transmitter. Otherwise, do not initialize the transmitter.
3. Transmitter generates An (session random number).
4. Transmitter writes An to the receiver, using the I2C bus.

   This step is the first interaction between the transmitter and receiver. The transmitter reads the Bksv, over the I2C bus, and verifies that it has 20 zeros and 20 ones.
5. Write the transmitter KSV to the receiver.
6. Read and verify the receiver KSV.
7. Write receiver KSV to transmitter.
8. Ri ready at transmitter.
9. The transmitter reads the Ri value from the receiver and compares it with its own generated Ri value. They should match to proceed. If this step fails, the test returns to step 1.
10. Generate authentication.
11. Transmitting encrypted data.

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12 Using Special Sync Output

Topics in this chapter:

- Operating special sync for probe pulse
- Configuring special sync for FS, LS or CS

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Overview

The generator is equipped with a Special Sync BNC connector labeled S/S on the front right side. You can configure the output of this video interface to output frame sync, line sync, composite sync or a special probe pulse.

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Operating special sync for probe pulse

The probe feature is used in connection with a programmable probe pulse that is available on the S/S BNC. This pulse is most often used to trigger an oscilloscope or synchronize an inspection camera. The probe feature allows you to position the leading edge of the probe pulse anywhere within the video frame. This feature greatly facilitates troubleshooting by enabling you to focus on specific video signal problems occurring anywhere in the video signal.

Configuring the probe feature involves positioning the probe pulse in the desired location on the video frame. You can do this either through the front panel or the command line interface. The front panel display is most convenient if you are near the generator and not using a computer or terminal. You can control the generator through the command line interface either locally or remotely through the serial connection.

Front panel controls and indicators

To use the probe feature begin by first activating the probe feature through the generator keys, and then positioning the pulse in the desired location by turning the Format knob (horizontal position) and the Image knob (vertical position). The current position of the pulse is shown on the LCD.

Probe coordinate numbering

Unlike ITU and SMPTE standards, Quantum Data standards count pixels, lines, and coordinates beginning with the number zero (not one) to improve the mapping between video signal specifications and modern computer graphics coordinates. The television standards are accounted for by suppressing any half-active line that appears in an equalizing interval and lengthening (to a full line) any half-active line that begins in the active portion of a field. Vertical counting always begins with the leading edge of blanking of the first field (not vertical sync). The first field is always defined as the field that includes the top line of the displayed picture (Y:0). This definition is always true whether the total number of active lines is odd or even.

With interlaced scanning, lines continue to be numbered sequentially throughout the frame, beginning with the leading edge of blanking of the first field. Therefore, the first two lines of blanking in the first field are numbered L:0 followed by L:1. If you have 525 total lines and 486 of those are active, for example, the first two (blank) lines of the second field would be numbered L:262 and L:263. The Y position continues to follow the visual order of lines going from the top to the bottom of the screen. If the last line of blanking in the first field is L:18, then L:19 corresponds to Y:0, L:20 to Y:2, L:21 to Y:4 and so on. In the second field, L:282 would correspond to Y:1, L:283 to Y:3, L:284 to Y:5 and so on.

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Configuring the probe feature

This section describes how to configure the probe feature.

To enable the probe feature:

1. Deactivate the signal outputs of the generator by pressing the **Outputs** key. The light on the **Outputs** key extinguishes.
2. Hold down the **Step** key, and then press and release the **Outputs** key. The LCD displays a *Probe feature* message, and then the following screen.
3. Release the **Step** key.

Setting sensitivity of knobs

You can control the amount of distance traveled with each click of the **Format** and **Image** knobs by using the **ACS**, **DCS**, and **DSS** keys. If neither **ACS**, **DCS**, nor **DSS** is selected, then the amount of movement is increased exponentially as you move farther in a particular direction and is reset when you change direction.

To set the sensitivity of the Format and Image knobs:

1. Press the appropriate key:

Sensitivity	Procedure
100 pixels/lines per knob click	Press the **ACS** key. The key illuminates.
10 pixels/lines per knob click	Press the **DCS** key. The key illuminates.
1 pixel/line per knob click	Press the **DSS** key. The key illuminates.

Controlling probe using generator controls

This section procedures for controlling the special sync probe through the front panel keys and knobs.

To position the probe pulse in a specific location in the video signal:

1. Turn the **Format** knob to set the horizontal position of the probe pulse to the desired pixel relative to the leading edge of the horizontal sync.

   The horizontal position of the probe is simultaneously displayed in two different ways:

   - The horizontal position P:*nnnn* is given in pixels relative to the leading edge of the horizontal sync.
   - If the leading edge of the probe is within the active portion of a line, an alternate horizontal position X:*nnnn* is also displayed, indicating the number of pixels

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between the start of active video (X:0) and the leading edge of the probe pulse in the horizontal direction.

2. Set the vertical position by turning the **Image** knob.

   The vertical position of the probe is simultaneously displayed in two different ways:

   - The vertical position *L:nnnn* is given in whole scan lines relative to the leading edge of blanking of the frame or first field.
   - If the probe is within the active portion of the frame, an alternate vertical position *Y:nnnn* is also displayed, indicating the number of lines between the start of active (Y:0) and the leading edge of the probe in the vertical direction.

To position and activate the probe pulse:

1. Press the **Step** key. The cursor appears. You may have to turn the **Format** and **Image** knobs to move the cursor into the active video. This feature allows you to visually move the probe to an area of interest (within the active portion of the frame) without using numerical coordinates.
2. Turn the **Format** knob to move the cursor horizontally. Turn the **Image** knob to move the cursor vertically.
3. Activate the probe pulse.

Action	Procedure
Activate the probe pulse on the specified scan line	Press the **R** and **G** keys. The light on the keys extinguish.
Activate the probe pulse on all active scan lines at the same horizontal position	Press the **R** key. The light on the key illuminates.
Activate the probe pulse on all scan lines, whether active or not at the same horizontal position	Press the **G** key. The light on the key illuminates.

Controlling probe using command line interface

Using the command line interface to control the probe provides more control, enables you to change the polarity and width, and to change the format and image while maintaining the probe pulse parameters.

To configure the probe feature:

1. Enable the probe feature by entering the following commands:

```
FSPG 0   // disable the frame sync on special sync output
PSPG 1   // enable the probe pulse
PSPP 1   // Set the probe pulse polarity (0 for low or 1 for high)
PSPW 10  // set pulse width to 10 pixels (range: 1 pixel to HTOT - 1)
```


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```
PSHD 100 // set pulse horizontal position at 100 pixels from leading
edge of horiztonal sync pulse, in range from 0 <= PSHD<(HTOT - PSPW - 1)
PSVD 50  // set the pulse vertical position at 50 lines from leadinig
edge of vertical blanking, in range from 0<=PSVD<(VTOT-1)
ALLU     // apply the settings
```

To set the lines on which the probe pulse occurs:

1. Send the appropriate command:

Set the probe pulse to occur	Command
Once per frame	`PSPM 0`
Once every active line	`PSPM 1`
Once every line	`PSPM 3`

2. Send the ALLU command to apply the setting.

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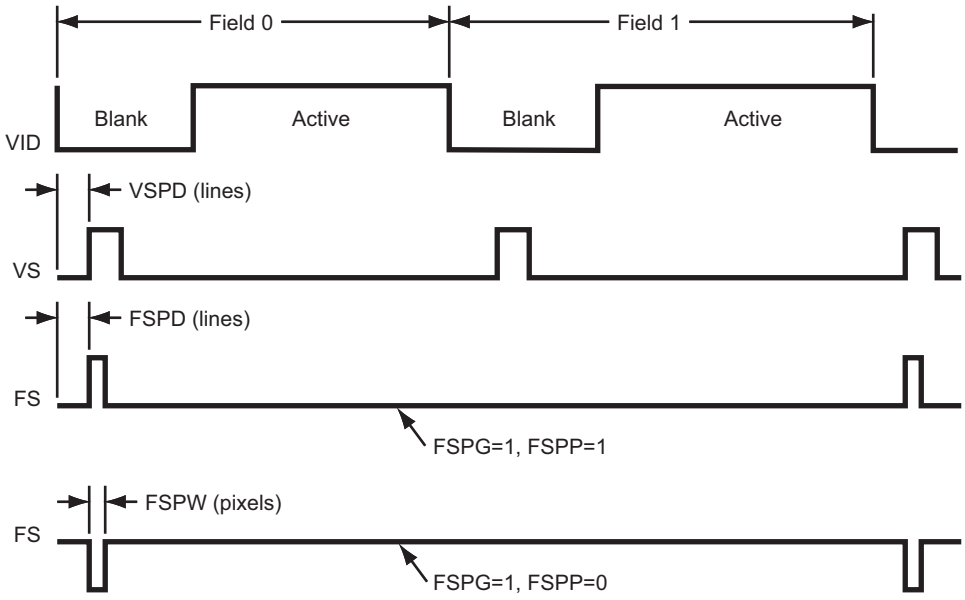
Configuring special sync for FS, LS or CS

The special sync output can provide frame sync, line sync, or composite sync signals. The output is controlled by setting parameters of these signals through the command line interface. The following commands are used to set the special sync signal:

- FSPG - Frame sync
- PSPG - Probe signal
- LSPG - Line sync
- CSPG - Composite sync

Note: *The special sync output is disabled whenever these parameters are set to zero.*

A frame pulse can be generated and output at the beginning of each frame. In the case of interlaced video, the frame pulse is output at the beginning of the blanking interval (of the first field) that immediately precedes the top line of active video.



To configure frame sync on the special sync output:

1. Enable the frame sync by entering the following command:

   ```
   FSPG 1
   ```

   The values of the other parameters (LSPG and CSPG) do not matter once FSPG is enabled.

2. Set the frame pulse polarity (either 0 for low or 1 for high) by entering the following command:

   ```
   FSPP 1
   ```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3. Set the frame pulse pixel width (in the range from 1 pixel to HTOT - 1) by entering the following command:

```
FSPW 100
```

4. Set the frame pulse delay (in the range from 0 <= FSPD < (VTOT - FSPW - 1) [default = 0]) by entering the following command:

```
FSPD 10
```

5. Save these settings by entering the following command:

```
ALLU
```

To configure line sync on the special sync output:

1. Enable the line sync signal by entering the following commands:

```
FSPG 0
PSPG 0
LSPG 1
ALLU
```

   The value of composite sync CSPG does not matter once these are set.

2. Set the line sync pulse polarity by entering the following command:

```
LSPP 1      // 1 = high (default)
ALLU
```

To configure composite sync on the special sync output:

1. Enable digital composite sync by entering the following command:

```
SSST 2 (or 6,11)
```

   Alternatively, you can press the **DCS** key on the front panel.

2. Enable the composite sync signal by entering the following commands:

```
FSPG 0
PSPG 0
LSPG 0
CSPG 1
ALLU
```

3. Set the composite sync pulse polarity by entering the following commands:

```
CSPP 1      // 1 = high (default)
ALLU
```


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A Command Reference

Topics in this appendix:

- Commands by name

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Commands by name

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*CLS

Clear Status

Class	GPIB
Description	Clears the Event Status Register, the Status Byte and the output buffer.
Command syntax	*CLS
Related commands	*ESR?, *STB

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*DDT

Delay Device Trigger

Class — Trigger

Description — Specifies a command or command string to be executed when the generator is “triggered” with the *TRG command. Only one *DDT command can be pending at a time. The command or query arguments must be enclosed in quotes.

Command syntax — *DDT “*command_1*; *command_2* ... *command_n*”

Example

```
*DDT “imgl flat; imgu”
*TRG   // to invoke the command line in quotes from the *DDT command
```

Related commands — *TRG

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*ESE

Event Status Enable

Class GPIB

Description Sets the Event Status Enable register to the given mask value. The bits in the Event Status Enable register function as enable bits for each corresponding bit in the Event Status register. That is, when a bit in the Event Status register goes high, and the corresponding bit in the Event Status Enable register is a 1, it is enabled and will cause the ESB bit in the Status Byte register to go high.

The *ESE? query returns the current value of the Event Status Enable register.

Command syntax *ESE *mask*

mask
0 - 255

Example *ESE 8

Query syntax *ESE?

Query response *mask* NL

Where *mask* is in integer NR1 form.

See also: *CLS, *ESR?

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*ESR?

Event Status Register

Class GPIB

Description Returns the current value of the Event Status register. After this command is executed, the Event Status register is cleared. This is the only way of clearing any bit in the Event Status register except by the *CLS command.

Query syntax *ESR?

Returns *registerValue* NL

Where *registerValue* is in integer NR1 form.

Related commands *CLS, *ESE

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*IDN?

IDeNtification

Class GPIB

Description Returns an equipment identification string formatted per IEEE-488.2 standards.

Query syntax *IDN?

Returns *Company*,*Model*,*SerialNumber*,*FirmwareVersion*

Company
Always QuantumData.

Model
Product model description.

SerialNumber
Serial number of nonvolatile SRAM module (Dallas chip) in generator.

FirmwareVersion
Version number of currently installed firmware.

Example
```
R:\*idn?
QuantumData,802BT-DVI-AN,7514191,7.38380000
```


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*OPC

OPeration Complete

Class GPIB

Description Causes the 882 to set the OPC bit in the Event Status register when all operations have been completed. Since there are no overlapping commands, the *OPC command will set the OPC bit immediately when executed.

The *OPC query will put a 1 in the output buffer when all operations are complete.

Command syntax *OPC

Query syntax *OPC?

Returns NL

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*RST

ReSet

Class GPIB

Description Performs a device reset. This places the 882 into a known condition. These conditions are:

- IEEE-488 address set to 15
- Status Byte cleared
- Input queue empty
- Output queue empty

Command syntax *RST

Related commands *CLS

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*SRE

Service Request Enable

Class GPIB

Description Sets the Service Request Enable register to the mask value given. The bits in the Service Request Enable register function as enable bits for each corresponding bit in the Status Byte register to enable a condition to request service from the system controller. That is, when a bit in the Status Byte register goes true, and the corresponding bit in the Service Request Enable register is also true, the 882 will request service through the GPIB. The *SRE query returns the current value of the Service Request Enable register.

Command syntax *SRE *mask*

mask
0 - 255

Example *SRE 16

Query syntax *SRE?

Returns *mask* NL

Where *mask* is in integer NR1 form.

Related commands *STB, *ESE

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*STB

STatus Byte

Class	GPIB
Description	Returns the current value of the Status Byte register. The value stored in the Status Byte register is not affected by reading it.
Query syntax	*STB?
Returns	*statusByte*<NL> Where *statusByte* is in integer NR1 form.
Related commands	*SRE, *ESR?, *CLS

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*TRG

TRiGger

Class GPIB port control

Description Triggers the generator programmatically. The *TRG command is used to trigger a command or command string entered with the *TRG command.

Command syntax *TRG

Example
```
*DDT "imgl flat;imgu"
*TRG   // Invoke the command line in quotes from the *DDT command
```

Related commands *DDT

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*TST

self TeST

Class GPIB port control

Definition: Causes the 882 to perform a self-test and report the results in a response message. If the self-test fails, an ASCII "1" is placed in the output buffer; otherwise, an ASCII "0" is placed in the output buffer.

Query syntax *TST?

Returns *result*<NL>

Where *result* is in integer NR1 form.

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*WAI

WAIt for completion suffix

Class GPIB port control

Description Causes the generator to wait until all processes have been completed before sending the prompt. Normally, the generator returns a prompt immediately after either an FMTU, IMGU, ALLU, BOOT, INIT, or SCAL command is received, even before these commands have finished executing. If the system controlling the generator must know when a command has finished executing, use a semicolon to append the suffix … ;*WAI. .

Command syntax *command*; *WAI

command
FMTU, IMGU, ALLU, BOOT, INIT, or SCAL

Example

```
FMTL vga_m3     // Load a format from memory to buffer
IMGL SMPTE133   // Load the SMPTE RP-133 image to buffer
ALLU; *WAI      // Update hardware to current buffer contents and delay
                // prompt until all done
```


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ADDR

memory ADDRess

Class — Direct processor control

Description — Sets the pointer register that is used in connection with the PUTR command and GETR? query. The ADDR? query returns the current contents of the pointer register.

Note: *This command is used only with custom applications and command files created by Quantum Data.*

Command syntax — ADDR *address*

address

0 to 4,294,967,295 (BASE = 10)

-2,147,483,648 to 2,147,483,647 (BASE = -10)

to FFFFFFFF (BASE = 16)

-80000000 to 7FFFFFFF (BASE = -16)

Query syntax — ADDR?

Query response — *address*

Other required commands — ADDR and ADDR? expect and return parameters formatted according to the current radix set by the BASE command.

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ADOT

draw A single pixel DOT

Class
Custom image primitive

Description
Draws a single pixel dot. A dot is the smallest graphic element that can be drawn. It uses three parameters: the color and the X and Y coordinates.

Command syntax
ADOT *color x y*

color
available colors

x
positive integer number

y
positive integer number

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
ADOT White 200 300  // Draw white dot at X = 200 Y = 300
ALLU                // Update hardware to current buffer contents
```


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ALIK

ALIas Kill

Class	Alias
Description	Removes an existing alias name.
Command syntax	ALIK *alias*
Example	`ALIK MYDMTFMT  // removes alias format name MYDMTFMT`
Related commands	ALIQ? to query alias names. ALIN to create an alias name.

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ALIN

create ALIas New

Class — Alias

Description — Creates an alias for an object such as a format, image or test sequence. You can create more than one alias name for an object.

Command syntax — ALIN *alias object*

Example

```
ALIN MYDMTFMT DMT0675  // creates alias format for format DMT0675
```

Related commands — Use ALIQ? to query alias names.

Use ALIK to remove an alias name.

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ALIQ?

ALIas Query

Class	Alias
Description	Lists alias names.
Query syntax	ALIQ? *start count*
Example	`ALIQ? 1 20  // show alias names from first alias name through 20th alias`
Related commands	ALIK to remove an alias name. ALIN to create an alias name.

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ALLE

end ALL Editor sessions

Class	Directory, format, image and sequence editor control
Description	Same as entering all of the DIRE, FMTE, IMGE and SEQE commands.
Command syntax	ALLE

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ALLU

ALL Use

Class — System control

Description — Checks the current contents of the format buffer for errors. If no errors are found, it reconfigures the signal generating hardware in accordance with the contents. Next, the current test image is re-rendered using the latest system and format parameter data.

Command syntax — ALLU

Other required commands — This command updates the generator after using the FMTL, IMGL and SEQL commands to load new files from memory. This command also can be used to see the results of work when using commands to edit formats or custom images.

Example

```
FMTL vga_m3  // Load a format from memory to buffer
ALLU         // Update hardware to current buffer contents
```


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AMAP

render A pixel MAP

Class — Bitmap image control

Description — Renders (copies) a pixel map stored in the generator as name to the frame buffer. The bitmap will be placed so that the top left corner will be at the given x, y location in the frame buffer.

Command syntax — AMAP *x y name*

x, y
location

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — AMAP?

Example —

```
AMAP 0 0 myicon  // Renders a pixel map called "myicon"
                 // in the top left corner of active video
```


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ANIG

ANalyzer Image Gate

Class — DVI signal analyzer

Description — Activates or deactivates the FormatRx and DeltaErr analyzer images.

Command syntax — ANIG *gate*

gate

0 = analyzer images are not activated

1 = analyzer images are activated

Query syntax — ANIG?

Query response — 0 or 1

Example

```
ANIG 1  // activates analyzer images
IMGL FormatRx; IMGU //outputs FormatRx image
```


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ANIM?

current test image has ANIMation

Class — Image editor control

Description — Returns a flag indicating if the image currently being displayed is animated.

Query syntax — ANIM? *imageName*

Query response — 0 = Not animated (static image) or the image was not found.

1 = Animated.

Example

```
ANIM? cubes    // to determine if the "cubes" image has animation
1              // response indicates that "cubes" is an animated image
```


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ANTI

ANTI-alias

Class	Image drawing primitives
Description	Causes other primitives to be drawn using anti-aliasing on diagonal edges when appearing anywhere in a custom image. This command affects only television formats on 801GX generators. It causes the leading and trailing edges of rectangles to have controlled rise and fall times.
Command syntax	ANTI
Other required commands	The IMGU or ALLU command must be used to redraw the custom image using anti-aliased primitives.

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ARAT

Audio sampling RATe

Class — Format parameter setting - Audio signal

Description — Sets the sampling rate of the audio stream output from the generator. This sets the CT parameter of the Audio InfoFrame (as specified in EIA/CEA-861-B, table 20).

Command syntax — ARAT *rate*

rate

- 192.0E3
- 176.4E3
- 96.0E3
- 88.2E3
- 48.0E3 (default)
- 44.1E3
- 32.0E3

Example

```
ARAT 48.0E3
IFGU
```

Related commands — XAUD (SF parameter)

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AROW

render A ROW of pixels

Class — Bitmap image control

Description — Renders (copies) binary stored as a hexstring to the frame buffer. The bitmap will be placed so that the top left corner will be at the given x, y location in the frame buffer.

Command syntax — AROW *x y bpp hexstring*

Query syntax — AROW?

Example

```
AROW 5 5 4 02D  // render hex data “02D” directly into frame
                // buffer at location 5, 5 at a depth of
                // 4 bits-per-pixel
```


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ASBG

Analog Sync on Blue Gating

Class — Format parameter setting - Analog video signal

Description — Enables and disables adding composite sync to the blue analog video outputs when analog sync is selected (see SSST command) and an analog video signal is being generated (see AVST command). The ASBG? query returns the current setting of ASBG.

See the ASSG command description for information on simultaneously controlling red, green and blue sync gating.

Command syntax — ASBG *mode*

mode

0 = OFF

1 = ON

Query syntax — ASBG?

Query response — *mode*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
ASBG 1  // Enable comp sync on blue in buffer
FMTU    // Update hardware to current buffer contents
```


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ASCT

Analog Sync Composite Type

Class — Format parameter setting - Analog video signal

Description — Sets the kind of composite sync added to the analog video outputs when analog sync is enabled (see SSST command) and an analog video signal is being generated (see AVST command). The ASCT? query returns the current setting of ASCT. A setting of zero (0) indicates that the ACS sync selection cannot be activated by the operator.

Command syntax — ASCT *type*

type

- 0 = none
- 1 = American HDTV ORed
- 2 = American ORed
- 3 = American w/serr
- 4 = American w/serr & eq
- 5 = European HDTV ORed
- 6 = European ORed
- 7 = European w/serr
- 8 = European w/serr & eq
- 9 = American HDTV w/serr
- 10 = American HDTV w/serr & eq
- 11 = European HDTV w/serr
- 12 = European HDTV w/serr & eq
- 13 = Japanese HDTV ORed
- 14 = Japanese HDTV w/serr
- 15 = Japanese HDTV w/serr & eq

Query syntax — ASCT?

Query response — *type*

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Other required commands

The SSST mode must be set to 4, 5, 6, or 7 and the AVST type must be set to 1, 2 or 5 in order for the ASCT setting to have any affect on the generator's hardware outputs. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
ASCT 2  // Enable Amer ORed comp sync in buffer
SSST 4  // Enable ACS
AVST 2  // Select analog RGB as video type
FMTU    // Update hardware to current buffer contents
```


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ASGG

Analog Sync on Green Gating

Class
(Obsolete) Format parameter

Description
Enables and disables adding composite sync to the green analog video outputs when analog sync is selected (see SSST command) and an analog video signal is being generated (see AVST command). The ASGG? query returns the current setting of ASGG.

See the ASSG command description for information on simultaneously controlling red, green and green sync gating.

Command syntax
ASGG *mode*

mode
0 = OFF

1 = ON

Query syntax
ASGG?

Query response
mode

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
ASGG 1  // Enable comp sync on green in buffer
FMTU    // Update hardware to current buffer contents
```


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ASRG

Analog Sync on Red Gating

Class
(Obsolete) Format parameter

Description
Enables and disables adding composite sync to the red analog video outputs when analog sync is selected (see SSST command) and an analog video signal is being generated (see AVST command). The ASRG? query returns the current setting of ASRG.

See the ASSG command description for information on simultaneously controlling red, green and red sync gating.

Command syntax
ASRG *mode*

mode
0 = OFF

1 = ON

Query syntax
ASRG?

Query response
mode

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
ASRG 1  // Enable comp sync on red in buffer
FMTU    // Update hardware to current buffer contents
```


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ASSC

Analog Sync Swing Calibration factor

Class — System calibration settings

Description — Sets the analog video calibration (or scaling) factor that's used to adjust the level set by ASSS. Issuing the command with a single factor sets all three analog video channels to the same value. Issuing the command with three factors sets each of the analog video channels to each of the given values. The actual peak-to-peak swing of the analog composite sync signals at the output connectors equals the product of ASSS multiplied by ASSC. The ASSC? query returns the current settings of ASSC. The default factory setting is 1.000 for this parameter.

Note: *The ASSC parameter is a system level parameter that affects the analog video swing of all formats that are recalled. The ASSC value is retained when the generator is powered down and back up again. Query the current setting of ASSC if you are experiencing problems with low or missing analog composite sync levels. Reinitializing the generator's memory restores the setting to factory default values of 1.000.*

Command syntax — ASSC *red_factor, green_factor, blue_factor*

or

ASSC *common_factor*

factor

min = 0.000 (floating point accepted)

max = 1.000 (floating point accepted)

Query syntax — ASSC?

Query response — *red_factor, green_factor, blue_factor*

Example

```
ASSC .995 .998 1.00  // Reduce red and green sync levels
FMTU                 // Update hardware to current buffer contents
```


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ASSG

Analog Sync Signal Gate

Class — Format parameter setting - Analog video signal

Description — Enables and disables adding composite sync to all three analog video outputs when analog sync is selected (see SSST command) and an analog video signal is being generated (see AVST command). This command can take the place of sending all three of the individual ASRG, ASGG, ASBG commands. The ASSG? query returns the current settings of the ASSG?

Command syntax — ASSG *red_mode*, *green_mode*, *blue_mode*

or

ASSG *common_mode*

mode

0 = OFF

1 = ON

(0, 0, 0 or 0, 1, 0 only choices on 801GC-ISA)

Query syntax — ASSG?

Query response — *red_mode*, *green_mode*, *blue_mode*

Other required commands — The SSST type must be 4, 5, 6 or 7 to output analog sync. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
ASSG 0,1,0  // Enable composite sync on green in buffer
FMTU        // Update hardware to current buffer contents
```


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ASSS

Analog Sync Signal Swing

Class — Format parameter setting - Analog video signal

Description — Sets the maximum peak-to-peak swing for any composite sync that is added to any of the three analog video channels. The actual peak-to-peak swing of the analog sync signals at the output connectors equals the product of ASSS multiplied by ASSC. The ASSS? query returns the current setting of ASSS.

Command syntax — ASSS *level*

level

min = 0.000 volts (floating point accepted)

max = 0.400 volts (floating point accepted)

Query syntax — ASSS?

Query response — *level*

Other required commands — One or more ASSG modes must be set to ON and the SSST type must be 4, 5, 6 or 7 to output analog sync. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
ASSS 0.286  // Set sync swing to 286 mV in buffer
FMTU        // Update hardware to current buffer contents
```


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AVCM

Analog Video Calibration Method

Class — System calibration setting

Description — Determines how the generator tests and calibrates its analog video outputs. The AVCM? query returns the current setting of AVCM.

Command syntax — AVCM *type*

type

0 = Interpolate

1 = Measure Interpolate

2 = Measure Set Absolute

3 = Test Levels

Query syntax — AVCM?

Query response — *type*

Example

```
AVCM 1  // Select Measure Interpolate
        // type of self cal
```


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AVCO

Analog Video COnfiguration

Class — Format parameter setting - Analog video signal

Description — Sets the mapping of the analog video colors to the video output connections. The AVCO? query returns the current setting of AVCO.

Command syntax — AVCO *type*

type

0 = RGB - R to R, G to G, B to B (Normal)

1 = RBG - R to R, B to G, G to B

2 = GRB - G to R, R to G, B to B

3 = GBR - G to R, B to G, R to B

4 = BRG - B to R, R to G, G to B

5 = BGR - B to R, G to G, R to B

Query syntax — AVCO?

Query response — *type*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
AVCO 5  // Output blue on red chan and red on blue chan
FMTU    // Update hardware to current buffer contents
```


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AVCS

Analog Video Color subcarrier Selection

Class — Format parameter setting - Analog video signal

Description — Sets the color subcarrier type used for the television outputs on generator models that have television outputs available. The AVCS? query returns the current setting of AVCS.

Command syntax — AVCS *type*

type

0 = No subcarrier

1 = NTSC-M, 3.579545 MHz (American)

2 = NTSC-44, 4.43361875 MHz (conversion format without phase alternation)

3 = PAL, 4.43361875 MHz (with phase alternation)

4 = PAL-Nc, 3.58205625 MHz (Argentina)

Query syntax — AVCS?

Query response — *type*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
AVCS 1  // Select standard American NTSC encoding
FMTU    // Update hardware to current buffer contents
```


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AVPG

Analog Video Pedestal Gate

Class
Format parameter setting - Analog video signal

Description
Enables and disables the analog video set-up pedestal. The AVPG? query returns the current setting of AVPG.

Command syntax
AVPG *mode*

mode
0 = OFF

1 = ON

Query syntax
AVPG?

Query response
mode

Other required commands
Analog video must be enabled with the AVST command in order to output an analog video signal. The pedestal level is set with the AVPS command. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
AVPG 1      // Enable use of a black level pedestal
AVPS 7.5    // Set pedestal level to 7.5 IRE
FMTU        // Update hardware to current buffer contents
```


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AVPS

Analog Video Pedestal Swing

Class — Format parameter setting - Analog video signal

Description — Sets a black pedestal level between the blanking level (0.0 I.R.E.) and the peak video level (100.0 I.R.E.). The AVPS? query returns the current setting of AVPS.

Command syntax — AVPS *level*

level

min = 0.0 I.R.E.

max = 100.0 I.R.E.

Query syntax — AVPS?

Query response — *level*

Other required commands — AVPG must be set to ON to enable the use of the pedestal. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
AVPG 1     // Enable use of a black level pedestal
AVPS 7.5   // Set pedestal level to 7.5 IRE
FMTU       // Update hardware to current buffer contents
```


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AVSS

Analog Video Signal Swing

Class — Format parameter setting - Analog video signal

Description — Sets the maximum peak-to-peak swing for all three analog video channels. The actual peak-to-peak swing of the analog video signals at the output connectors equals the product of AVSS multiplied by AVSC. The AVSS? query returns the current setting of AVSS.

Command syntax — AVSS *level*

level
0.000 to 1.000 volts (floating point accepted)

Query syntax — AVSS?

Query response — *level*

Other required commands — Analog video must be enabled with the AVST command in order to output an analog video signal. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example 1 — This example uses the AVSS command changes the output level of the NTSC format from 714mV to 500mV, and adds the revised format to the format knob list.

```
FMTL NTSC
FMTB
AVSS 0.5
FMTE
FMTA NTSC_1

DIRL fmt
DIRB
NAMI 1 NTSC_01
DIRE
DIRS
```

Example 2 — This example enables analog video, and sets the video swing.

```
AVST 2          // Select RGB component color video in buffer
AVSS 0.714      // Set to 714 mV in buffer
FMTU            // Update hardware to current buffer contents
```


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Example 3 This example changes the sync level from 286mV to 200mV, and sets the video output level at 500mV.

```
FMTL NTSC
FMTB
ASSS 0.2
AVSS 0.7
FMTE
FMTA NTSC_1
```


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AVST

Analog Video Signal Type

Class — Format parameter setting - Analog video signal

Description — Establishes the type of signal that appears on the analog video outputs of the generator. The AVST? query returns the current setting of AVST.

Command syntax — AVST *type*

type

0 = none

1 = Analog Y (grayscale)

2 = Analog RGB (color)

3 = CVBS or S-Video grayscale

4 = CVBS or S-Video color

5 = Analog YPrPb (old SMPTE 240M HDTV)

6 = Analog YCrCb ITU BT.601 (ANSI/SMPTE 170M TV)

7 = Analog YPrPb SMPTE RP177 HDTV

8 = YPrPb ITU-R BT.709 HDTV

Query syntax — AVST?

Query response — *type*

Other required commands — DVST must be set to zero when analog video is used. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
DVST 0  // Disable digital video
AVST 2  // Select RGB component color video
ALLU    // Update hardware and redraw test image
```


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BALG

dc BALancing Gate

Class — Format parameter setting - Digital video signal

Description — Enables and disables adding DC balancing to the Open LVDI digital outputs on generators that support LVDI outputs. FPD-Link compatible displays use unbalanced (BALG 0), while OpenLDI displays use balanced (BALG 1).

The BALG? query returns the current setting of BALG.

Command syntax — BALG *mode*

mode

0 = OFF

1 = ON

Query syntax — BALG?

Query response — *mode*

Other required commands — FMTU or ALLU

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BASE

number BASE

Class
Direct processor control

Description
Establishes the radix of address and data parameters passed to or returned from the ADDR, GETA, GETR, PUTA, PUTR, and CALL commands. If a negative radix is specified, then parameters passed to (or returned from) these functions are assumed to be signed.

For example, if BASE= -16, then the value -1 communicates the value FFFFFFFF hex. The BASE? query returns the current setting of BASE. The radix *radix* always is passed and returned in base 10, regardless of the setting of BASE. BASE is preset to -10 each time the generator is powered on. Base -10 is the preferred radix. The BASE? query returns the current setting of BASE.

Note: *This command is used only with custom applications and command files created by Quantum Data.*

Command syntax
BASE *radix*

radix
-36 to -2 or 2 to 36

Query syntax
BASE?

Query response
radix

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BLUG

BLUe Gate

Class	Video Gate
Description	Toggles the blue video signal gate.
Command syntax	BLUG *mode* *mode* 0 disable 1 enable
Query syntax	BLUG?
Query response	0 or 1
Other required commands	ALLU to invoke the command.
Related commands	GRNG, REDG
Example	`BLUG 0; ALLU  // disable blue video component`

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BOIT

BOot and IniTialize

Class	System control
Description	Initializes the generator without going through a self-calibration.
Command syntax	BOIT

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BOOT

warm BOOT

Class System control

Description Causes the generator to go through its standard power-up procedure. Self-calibration is not performed. The procedure checks all RAM storage locations for corrupt data. This command is equivalent to turning the generator off and then on.

Command syntax BOOT

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BRAT

Bit RATe

Class — Format parameter setting - Digital audio signal

Description — Sets the bit rate (in Hz) for an external compressed audio source. This sets the MBR parameter of the Audio InfoFrame (as specified in EIA/CEA-861-B).

The BRAT? query returns the current compressed digital audio bit rate

Command syntax — BRAT *rate*

rate

0.0 (audio is not compressed)

8000, 16000, 24000 (or higher multiple of 8,000)

Query syntax — BRAT?

Example

```
BRAT 32000
IFGU
```

Related commands — XAUD (MBR parameter)

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CACH

instruction CACHe enable

Class — System parameter settings

Description — Enables and disables the use of the instruction cache. The CACH? query returns the current setting of CACH.

Command syntax — CACH *mode*

mode

0 = OFF

1 = ON

Query syntax — CACH?

Query response — 0 or 1

Example

```
CACH 0  // Disable the use of the instruction cache
```


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CALF

analog video CALibration Factors

Class — System calibration settings

Description — Sets the analog output calibration factors to values other than those set by the generator's own self-calibration function. Each channel is calibrated using two independent zero calibration points, and two independent slope calibration points. Interpolation equations for the different video types are used to set the caldac values that controls the output sync and voltage levels to the correct values.

TV calibration uses two factors for NTSC output, and two factors for PAL output.

Note: *Sending bad calibration factors to the generator via the CALF command can hang the generator. If the generator hangs it will have to be reinitialized.*

Command syntax — CALF *zero500R*, *zero50R*, *slope1500R*, *slope1000R*, *zero500G*, *zero50G*, *slope1500G*, *slope1000R*, *zero500B*, *zero50B*, *slope1500B*, *slope1000B*, *ntsc714*, *pal700*, *ntsc_blank*, *pal_blank*

zero500R
: Red calibration factor from 0 (most negative) to 4095 (least negative) at -1.0V.

zero50R
: Red calibration factor from 0 (most negative) to 4095 (least negative) at -100mV.

slope1500R
: Red calibration factor from 0 (maximum swing) to 4095 (minimum swing) at 2.0V.

slope1000R
: Red calibration factor from 0 (maximum swing) to 4095 (minimum swing) at 1.4V.

zero500G, zero50G, slope1500G, slope1000R
: Green calibration factors.

zero500B, zero50B, slope1500B, slope1000B
: Blue calibration factors.

ntsc714
: Factor from 0 (maximum swing) to 4095 (minimum swing) for NTSC output level at 714mV. The *ntsc714* and *ntsc_blank* values are interrelated.

pal700
: Factor from 0 (maximum swing) to 4095 (minimum swing) for PAL output level at 700mV.

ntsc_blank
: Factor from 0 (least negative) to 4095 (most negative) used to set the zero level of the NTSC output at 0.0 IRE.

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pal_blank

Factor from 0 (least negative) to 4095 (most negative) used to set the zero level of the PAL output at 0.0 IRE.

Query syntax CALF?

Related commands The AVSC command matches the levels for the three analog video channels. The ALLU command updates the signal generating hardware to the new settings and redraws the test image.

Example

```
CALF 1090, 2590, 1992, 3223, 1149, 2634, 2059, 3278, 1001, 2506, 1993,
3221, 781, 780, 3387, 3513            // Set new factors
ALLU                                  // Use new factors
```


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CALL

CALL internal function

Class — Direct processor control

Description — Calls internal C functions. Address *address* is the entry point of the C function to be called. Parameter passed indicates the number of parameters to be passed. If passed is not zero, then parameters being passed p(1) through p(n) immediately follow the passed parameter on the command line.

The CALL? query is similar to the CALL command except that returned parameters are expected. Here, a third parameter returned is added to indicate the number of parameters returned by the function. If BASE= -10 or -16 and a returned value of -1 is given (4,294,967,295 if BASE=10 or FFFFFFFF if BASE=16), then a single value is read from register A8 of the TMS34010 (rather than being popped off the C stack). Most C functions that return a single parameter return their single parameter in this way. Returned parameters are space-delimited and formatted according to the current radix (see BASE command). All parameters passed to the CALL and CALL? must be formatted according to the current radix. This includes the parameters passed and returned.

Note: *This command is used only with custom applications and command files created by Quantum Data. Indiscriminate use of this command can cause the generator to stop operating or loss of stored data in non-volatile RAM.*

Command syntax — CALL *address passed* [*p(1)* [*p(2)* [*p(3)* …[*p(18)*]…]]]

address

0 to 4,294,967,295 (BASE = 10)

-2,147,483,648 to 2,147,483,647 (BASE = -10)

0 to FFFFFFFF (BASE = 16)

-80000000 to 7FFFFFFF (BASE = -16)

passed

0 to 18 (BASE = -10 or 10)

0 to 12 (BASE = -16 or 16)

p(n)

0 to 4,294,967,295 (BASE = 10)

-2,147,483,648 to 2,147,483,647 (BASE = -10)

0 to FFFFFFFF (BASE = 16)

-80000000 to 7FFFFFFF (BASE = -16)

Query syntax — CALL? *address passed returned* [*p(1)* [*p(2)* [*p(3)* …[*p(17)*]…]]]

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address

0 to 4,294,967,295 (BASE = 10)

-2,147,483,648 to 2,147,483,647 (BASE = -10)

0 to FFFFFFFF (BASE = 16)

-80000000 to 7FFFFFFF (BASE = -16)

passed

0 to 18 (BASE = -10 or 10)

0 to 12 (BASE = -16 or 16)

returned

4,294,967,295 and 0 to 20 (BASE = 10)

-1 to 20 (BASE = -10)

FFFFFFFF and 0 to 14 (BASE = 16)

-1 to 14 (BASE = -16 query only)

p(n)

0 to 4,294,967,295 (BASE = 10)

-2,147,483,648 to 2,147,483,647 (BASE = -10)

0 to FFFFFFFF (BASE = 16)

-80000000 to 7FFFFFFF (BASE = -16)

Query response

ret(1) [*ret(2)* [*ret(3)* … [*ret(20)*]…]]

Other required commands

CALL and CALL? expect and return parameters formatted according to the current radix set by the BASE command.

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CENT

draw video CENTering markers

Class
Custom image primitive

Description
Draws a small cross in the center of active video. If the format has an even number of active pixels, the vertical line is 2 pixels thick. The horizontal line is 2 pixels thick if the format has an even number of active lines. The primitive uses a single parameter, the color of the cross.

Command syntax
CENT *color*

color
available colors

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
CENT red  // Draw a small red cross in center of active video
ALLU      // Update hardware to current buffer contents
```


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CROS

draw a centered CROSs

Class
Custom image primitive

Description
Draws a large centered cross that fills the active video area. The vertical line is 2 pixels thick if the format has an even number of active pixels. The horizontal line is 2 pixels thick if the format has an even number of active lines. The primitive uses a single parameter, the color of the cross.

Command syntax
CROS *color*

color
available colors

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
CROS magenta  // Draw a large cross in the center of the active video
ALLU          // Update hardware to current buffer contents
```


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CSPG

Composite Sync Pulse Gate

Class — Format parameter setting - Synchronization

Description — Enables and disables all of the digital composite sync outputs when digital composite sync is selected via the SSST command (SSST = 3). The CSPG? query returns the current setting of CSPG.

Command syntax — CSPG *mode*

mode

0 = OFF

1 = ON

Query syntax — CSPG?

Query response — 0 or 1

Other required commands — In order to use digital composite sync, it must be selected with the SSST command. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
CSPG 1  // Enable dig comp sync in buffer
SSST 2  // Choose digital comp sync type in buffer
FMTU    // Update hardware to current buffer contents
```


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CSPP

Composite Sync Pulse Polarity

Class — Format parameter setting - Synchronization

Description — Establishes the logic sense of the digital composite sync output. The CSPP? query returns the current setting of CSPP.

Command syntax — CSPP *polarity*

polarity

0 = active-low (negative going pulse)

1 = active-high (positive going pulse)

Query syntax — CSPP?

Query response — 0 or 1

Other required commands — In order to use digital composite sync, it must be gated on with the CSPG command and selected with the SSST command. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
CSPG 1  // Enable dig comp sync in buffer
CSPP 1  // Select active hi in buffer
SSST 2  // Choose digital comp sync type in buffer
FMTU    // Update hardware to current buffer contents
```


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CTLM

ConTroL Mask

Class — Format parameter setting - Digital video signal

Description — Sets the masked control bits for the LVDS output. The control bits are not always required by receivers. There are two bits that can be set: CTL00 and CTL01.

Command syntax — CTLM *mask*

mask

0 = sets bit low

1 = sets bit high

Query syntax — CTLM?

Example

```
CTLM 2  //  the 2 in hex sets the CTL01 bit to 1.
CTLM 3  //  the 3in hex ets the CTL00 and CTL01 bits to 1.
```

Related commands — RCTL

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CXAR

Content Aspect Ratio

Class Format parameter setting - HDMI Active Video

Description Sets the aspect ratio of the source image content.

Command syntax CXAR *aspect_ratio*

aspect_ratio

0.75 to ˜2.39

The following table provides a listing of established aspect ratios.

Aspect Ratio	Symbol	Description	Examples
0.750	OT or T_{90}	Television Portrait	3x4, 480x640, 600x800, 768x1024, 960x1280, 1200x1600
0.800	OG or G_{90}	Workstation Graphics Portrait	4x5, 1024x1280, 1280x1600
1.000	Q	Quadrate, "Square”	1x1, 512x512, 1024x1024
1.250	G	Workstation Graphics	5x4, 1280x1024, 1600x1280
1.333…	T (A)[1]	SDTV / Silent Film	4x3, 640x480, 800x600, 1024x768, 1280x960, 1600x1200
˜1.37	C (B)[1]	Academy[2] “Classic” with sound	˜4x3, 0.825x0.602 SMPTE RP40 35mm "C"
1.444…	I	IMAX™	13x9, IMAX™
1.500	V (T)[1]	Vista Vision™	3x2, 1152x768 Apple Computer (uncropped) Vista Vision™
1.555…	M (V)[1]	Mid	14x9, AFD Shoot and Protect (half-way between 4x3 and 16x9)
1.600	D	16 Decimal	16x10, 1728x1080, 1280x800, see VESA CVT 1.0
1.666…	E	European Film, "1.66	5x3, 1200x720, 1280x768, 1800x1080
1.750	Z	Old Film	7x4, Old Metro-Goldwyn-Mayer and Disney Films
1.777…	H	HDTV	16x9, 1280x720,1920x1080
˜1.85	A (F)[1]	Film Standard (USA)	˜13x7, 1280x692, 1920x1038, 0.825x0.446 SMPTE RP40 35mm "A"
2.000	U	Univisum™	2x1, 1280x640, 1920x960
˜2.20	F (M)[1]	“Flat”, MPEG "20x9"	"˜11x5, 1280x582, 1920x874, 1.912x0.870 SMPTE RP91 70mm
˜2.39	B (C)[1]	Anamorphic Cinema, “2.35”[3]	˜12x5, 1280x536, 1920x804, 1.650x0.690 SMPTE RP40 35mm "B"

1. The letters in parenthesis are the letters that we used to use, before we updated our aspect ratio symbols for compatibiliity with existing film industry standards (i.e. the symbols defined in SMPTE RP40).
2. In 1932, the shape of film was changed from 1.33:1 to 1.37:1 in order to better accommodate the new optical soundtrack that was added a few years earlier. This slightly wider shape is the true aspect ratio of “classic” film. The aperture is commonly referred to as “Academy” and was the shape of the vast majority of U.S. films produced until the 1950s.
3. Sometimes called “2.35”, which was the aspect ratio before it was changed to 2.39:1 in 1971 to keep splices from showing up in the projected image.

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Related commands EXAR, SXAR

Example
```
CXAR 1.33 //Sets 4:3 picture aspect ratio for source content
FMTU
```


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DACA

Digital Audio Channels Available

Class — Format parameter setting - Audio signal

Description — Specifies which audio channels are active.

Command syntax — DACA *mask*

mask

0 to 3, based on following table.

Channel	1	2
Bit	0	1
Value	1	2

Normally, each type of audio content is assigned to a particular channel and is always output on that channel when present. There is one exception to this rule: rear center (RC) content is switched from channel 5 to 7 whenever rear left (RL) content is simultaneously present. To simplify this, RC content is thus treated as if it were two different types of content: RC5 and RC7. When RL content is not present, RC content is output on channel 5 as RC5 content. When RL content is present, RC content is output on channel 7 as RC7 content.

Setting DACA will automatically set DAXA and XAUD:CA parameters to a corresponding value (see table below).

DACA	3
DAXA	3
XAUD:CA	0

Note: *If DACA is set to a value not found in the table above, then other parameters will not be automatically set and an error will be generated if the format is loaded while this condition exists.*

mask

0 to 255 (based on the value in the table below).**Notes:**

- Setting DACA will automatically set DAXA and XAUD:CA parameters to a corresponding value (see table below). However, in the case of DACA values 243, 247, 251, and 255, two sets of DAXA and XAUD:CA values are possible. In this case, DAXA and XAUD:CA settings will be based on those highlighted (in grey) in the table.
- If DACA is set to a value not found in the table above, then other parameters will not be automatically set and an error will be generated if the format is loaded while this condition exists.

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Example

```
DACA 3 //specifies audio channels 1 and 2
DACG 3 //gates audio channels 1 and 2
FMTU
```

Related commands DACG

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DACG

Digital Audio Channel Gate

Class — Format parameter setting - Audio signal

Description — Specifies which audio channels are gated (on).

Command syntax — DACG *mask*

mask

0 to 3 (based on the value in the table below).

Channel	1	2
Bit	0	1
Value	1	2

Example

```
DACA 3 //specifies audio channels 1 and 2
DACG 3 //gates audio channels 1 and 2
FMTU
```

Related commands — DACA

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DADG

Digital Audio Down-mix Gate

Class — Format parameter setting - Audio signal

Description — Enables or disables downmixing of an audio signal. This sets the DM_I parameter of the Audio InfoFrame (as specified in EIA/CEA-861-B, table 24).

Command syntax — DADG *mode*

mode

1 = enable

0 = disable

Example

```
DADG 1
FMTU
IFGU
```

Related commands — XAUD (DMI parameter), DALS

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DALS

Digital Audio Level Shift Value

Class — Format parameter setting - Audio signal

Description — Sets the level shift value (in decibels) for downmixing of the audio signal. This sets the LSV parameter of the Audio InfoFrame (as specified in EIA/CEA-861-B, table 23).

Command syntax — DALS *x*

x
0 - 15 (dB)

Example

```
DALS 5
FMTU
IFGU
```

Related commands — XAUD (LSV parameter), DADG

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DASI

Digital Audio Signal Interface

Class — Format parameter setting - Audio signal

Description — Sets the digital audio signal interface.

Command syntax — DASI *interface*

interface

0 = none

1 = SPDIF

Example

```
DASI 1
IFGU
```


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DAST

Digital Audio Signal Type

Class — Format parameter setting - Audio signal

Description — Sets the digital audio signal type for an audio signal. This sets the CT parameter of the Audio InfoFrame (as specified in EIA/CEA-861-B, table 19).

Command syntax — DAST *type*

type

0 = void

1 = IEC 60958-3 Consumer LPCM

Example

```
DAST 1
IFGU
```

Related commands — XAUD (CT parameter)

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DAXA

Digital Audio Content Available

Class — Format parameter setting - Audio signal

Description — Specifies which speaker locations are available (present).

Command syntax — DAXA *mask*

mask

0 to 3 (based on the value in the table below).

Normally, each type of audio content is assigned to a particular channel and is always output on that channel when present. There is one exception to this rule: rear center (RC) content is switched from channel 5 to 7 whenever rear left (RL) content is simultaneously present. To simplify this, RC content is thus treated as if it were two different types of content: RC5 and RC7. When RL content is not present, RC content is output on channel 5 as RC5 content. When RL content is present, RC content is output on channel 7 as RC7 content.

Content	FR	FL
Bit	1	0
Value	2	1

Setting DAXA will automatically set DACA and XAUD:CA parameters to a corresponding value (see table below). However, this method should not be used to gate channels. Instead, DAXG should be used after all of the available channels have been selected.

DAXA	3
DACA	3
XAUD:CA	0

Note: *If DAXA is set to a value not found in the table above, then other parameters will not be automatically set and an error will be generated if the format is loaded while this condition exists.*

Example

```
DAXA 3 //specifies FR and FL as having audio content
DAXG 3 //gates FR and FL content
FMTU
```

Related commands — DAXG

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DAXG

Digital Audio Content Gate

Class — Format parameter setting - Audio signal

Description — Specifies which speaker locations are gated (on).

Command syntax — DAXG *mask*

mask

0 to 3 (based on the value in the table below).

Content	FR	FL
Bit	1	0
Value	2	1

Example

```
DAXA 3 //specifies FR and FL as having audio content
DAXG 3 //gates FR and FL content
FMTU
```

Related commands — DAXA

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DCBM

Display Code Bit Mask

Class — Direct processor control

Description — Sets the 4-bit binary bit mask used by the DCRD? query. The mask is entered as the decimal equivalent of a 4-bit binary number. The binary number represents the masking of the individual sense lines from M3 (MSB) to M0 (LSB). The DCBM? query returns the current setting of DCBM.

Command syntax — DCBM *mask*

mask

0 = 0 0 0 0	8 = 1 0 0 0
1 = 0 0 0 1	9 = 1 0 0 1
2 = 0 0 1 0	10 = 1 0 1 0
3 = 0 0 1 1	11 = 1 0 1 1
4 = 0 1 0 0	12 = 1 1 0 0
5 = 0 1 0 1	13 = 1 1 0 1
6 = 0 1 1 0	14 = 1 1 1 0
7 = 0 1 1 1	15 = 1 1 1 1

Query syntax — DCBM?

Query response — *mask*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
DCBM 7  // Set mask to read sense lines 0, 1 and 2 only
FMTU    // Update hardware to current buffer contents
```


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DCEX

Display Code EXpected

Class — Format parameter settings

Description — Sets up the display code that is expected from a display connected to the generator. The code is determined by one or more sense lines being connected to ground by the display. Many video controller cards for the Apple Macintosh II and VGA type cards for the IBM-PC sample the status of the display code sense lines. The information then sets up one of several different operating modes to match a particular display. An improper display code may make the controller card or display appear to malfunction.

The DCEX? query first performs a logical AND operation with the display code bit mask and the actual display code that's sensed. The decimal equivalent of the result then is returned. The mask is set with the DCEX command.

The expected setting and the actual result are both shown in the Format test image. They have no effect how a given format generates a set of test signals.

Command syntax — DCEX *code*

code

0 = 0 0 0 0	8 = 1 0 0 0
1 = 0 0 0 1	9 = 1 0 0 1
2 = 0 0 1 0	10 = 1 0 1 0
3 = 0 0 1 1	11 = 1 0 1 1
4 = 0 1 0 0	12 = 1 1 0 0
5 = 0 1 0 1	13 = 1 1 0 1
6 = 0 1 1 0	14 = 1 1 1 0
7 = 0 1 1 1	15 = 1 1 1 1

Query syntax — DCEX?

Query response — *code*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
DCBM 7  // Set mask to read sense lines 0, 1 and 2 only
DCEX 5  // Only lines 0 and 1 should be grounded
FMTU    // Update hardware to current buffer contents
```


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DCPG

Data Channel Power Gate

Class EDID and DDC control

Description Enables and disables the +5V power signal used by the DDC channel.

Command syntax DCPG *option*

option

0 = disable +5V power

1 = enable +5V power

Example `DCPG 0`

Related commands DCPX?

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DCPX?

Data Channel Power Overcurrent

Class EDID and DDC control

Description Queries the status of the 5V display data channel (DDC) power level.

Query syntax DCPX?

Returns 0 or 1

0 = OK

1 = overcurrent (for example, shorted)

Example
```
DCPX?
0
```

Related commands DCPG

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DCRD?

Display Code ReaD

Class — Direct processor control

Description — Returns the display code detected on the monitor sense lines as filtered through the display code bit mask. Converting the returned decimal number to a 4-bit binary number shows the status of the individual sense lines from M3 (MSB) to M0 (LSB).

Query syntax — DCRD?

Query response — *code*

code

0 = 0 0 0 0	8 = 1 0 0 0
1 = 0 0 0 1	9 = 1 0 0 1
2 = 0 0 1 0	10 = 1 0 1 0
3 = 0 0 1 1	11 = 1 0 1 1
4 = 0 1 0 0	12 = 1 1 0 0
5 = 0 1 0 1	13 = 1 1 0 1
6 = 0 1 1 0	14 = 1 1 1 0
7 = 0 1 1 1	15 = 1 1 1 1

Other required commands — DCBM sets the mask used for reading the display code.

Example

```
DCRD?  // Return current sense lines reading
```


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DDCV?

DDC Version supported

Class EDID and DDC control

Description The DDCV? query returns a status flag indicating if the generator hardware supports VESA DDC communications.

Query syntax DDCV?

Query response 0 or 1

0 = no DDC support

1 = DDC supported

Example
```
DDCV?  // Return DDC support information
```


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DELX

slider image DELta X

Class — Image editor control

Description — Sets the amount of horizontal shift that occurs for each step of the SlideG and SlideRGB built-in images. The command is also used to set the horizontal size of the white patch used in the Regulate image. The DELX? Query returns the current DELX setting.

Command syntax — DELX *delta_x*

delta_x
horizontal distance in pixels

Query syntax — DELX?

Query response — *delta_x*

Example

```
DELX 8         // Set H shift to 8 pixels per step
DELY 3         // Set V shift to 3 pixels per step
DWEL 2         // Display each step for 2 frames
IMGL "SlideG" // Select Image that uses DELX and DELY
IMGU           // Draw the Image
```


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DELY

slider image DELta Y

Class — Image editor control

Description — Sets the amount of vertical shift that occurs for each step of the SlideG and SlideRGB built-in images. The command is also used to set the vertical size of the white patch used in the Regulate image. The DELY? Query returns the current DELY setting.

Command syntax — DELY *delta_y*

delta_y
vertical distance in pixels

Query syntax — DELY?

Query response — *delta_y*

Example —

```
DELX 8          // Set H shift to 8 pixels per step
DELY 3          // Set V shift to 3 pixels per step
DWEL 2          // Display each step for 2 frames
IMGL "SlideG" // Select Image that uses DELX and DELY
IMGU            // Draw the Image
```

Description — Updates hardware with new EDID contents.

Command syntax — DIDU

Example —

```
XDID 8 3 DE33FF
DIDU
```

Related commands — XDID

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DIRA

DIRectory save As

Class — Directory memory management

Description — Saves the current contents of the directory edit buffer using the given name.

Command syntax — DIRA *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Example

```
DIRA MY_DIR  // Save with the name "MY_DIR"
```


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DIRB

DIRectory editing Begin

Class — Directory memory management

Description — Marks the beginning of a directory editing session. This command does nothing in the current firmware version, but is used for compatibility with future versions of firmware.

Command syntax — DIRB

Other required commands — Use either a DIRL command to load an existing directory or a DIRN command to create a new directory. Use DIRE when ending the editing session.

Example

```
DIRN  // Initialize directory edit buffer
DIRB  // Start directory editing session

      //  One or more directory editing commands ...

DIRE  // End directory editing session
```


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DIRE

DIRectory editing End

Class — Directory memory management

Description — Marks the end of a directory editing session. This command does nothing in the current firmware version, but is used for compatibility with future versions of firmware.

Command syntax — DIRE

Other required commands — Use DIRB when starting the editing session. Use EDID and DDC controlDIRA or DIRS to save changes.

Example

```
DIRB           // Start directory editing session

               // One or more directory editing commands ...

DIRA MYDIR_02  // Save edited directory as MYDIR_02
DIRE           // End directory editing session
```


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DIRK

DIRectory Kill

Class — Directory memory management

Description — Deletes a directory by name. The query returns a one if the named directory can be deleted. If directory is read-only or nonexistent, the query returns a zero.

Command syntax — DIRK *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — DIRK? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response — 0 or 1

Example

```
DIRK MY_DIR  // Delete directory called "MY_DIR"
```


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DIRL

DIRectory Load

Class — Directory memory management

Description — Copies the directory having a name equal to *name* from directory memory into the directory edit buffer. The query returns a one if the named directory can be loaded; otherwise, a zero is returned.

Note: *Use the FMTP, IMGP and SEQP commands to select which directory is used for the format, image, and sequence selection lists.*

Command syntax — DIRL *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — DIRL? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response — 0 or 1

Example

```
DIRL MY_DIR  // Load "MY_DIR" directory in edit buffer
```


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DIRN

DIRectory New

Class — Directory memory management

Description — Initializes the directory edit buffer. The name *name* is assigned as the directory's name. The query will return the name that has been assigned as the directory's name.

Command syntax — DIRN *name*

name
optional valid MS-DOS filename (8 characters minus any extension)

Query syntax — DIRN?

Example

```
DIRN  // Init edit buffer without assigning a new name
```

or

```
DIRN MY_DIR  // Init edit buffer with name of "MY_DIR"
```


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DIRP

DIRectory Path

Class — Directory memory management

Description — Sets the current directory path name. The query will return the current directory path name.

Command syntax — DIRP *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — DIRP?

Query response — *name*

Example

```
DIRP DIRPTH01  // Set directory path to DIRPTH01
```


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DIRQ?

DIRectory Query pointer

Class — Directory memory management

Description — Returns the number directory names from the list of all the directory names stored in directory memory beginning at index. The directories are kept in alphanumeric order.

Query syntax — DIRQ? *index number*

index
positive integer number

number
positive integer number

Query response — List of specified directory names

Example

```
DIRQ? 1 5     // List the first five directories in memory
```

or

```
DIRQ? 1 9999  // List all directories in memory
```


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DIRS

DIRectory Save

Class Directory memory management

Description Saves the current directory edit buffer contents into directory memory using the current name of the directory in the edit buffer.

Example

```
DIRN fmtnew       // creates a new format directory (knob list) name
DIRB              // begins a directory editing session
NAMI 1 myfmt1     // adds myfmt1 to directory (knob list)
.
.                 // add other formats to directory (knob list)
.
NAMI n myfmtn     // adds myfmtn to directory (knob list)
DIRE              // ends the directory editing session
DIRS              // saves the directory
```


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DMAP

Dimension bitMAP

Class — Bitmap image control

Description — Defines the size of a rectangular bitmap array in the edit buffer. The width and height, in pixels is set by the width and height parameters. The number of data bits per pixel is set by the *bpp* parameter.

Command syntax — DMAP *width height bpp*

width
min =

max =

height
min =

max =

bpp
1, 2 or 4

Query syntax — DMAP?

Query response — *width height bpp*

Example

```
DMAP 32 20 4  // Set bitmap array to 32 pixels wide by 20 pixels high
              // and a depth of 4 bits-per-pixel
```


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DNUM

Display sequence step NUMbers

Class — Sequence editor commands

Description — Enables and disables the addition of the sequence step number to the displayed test image when running a sequence.

Command syntax — DNUM *mode*

mode
0, 1 or 2

Query syntax — DNUM?

Query response — *mode*

Example

```
DNUM 1  // Enable the displaying of the sequence step #
```


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DPGU

Data Island Packet Generator Use

Class Data packet generator

Description Updates the hardware with content of the current Data Island packet.

Command syntax DPGU

Related Commands DPTG

Example 1 Turn mute on:

```
XGCP 1 0
DPTG 7
DPTR 1
DPGU
```

Example 2 Read mute status:

```
R:MUTE?
R:1
```

Example 3 Turn mute off:

```
XGCP 0 1
DPTG 7
DPTR 1
DPGU
```

Example 4 Read mute status:

```
R:MUTE?
R:0
```

Example 5 Change the N value to 6000, and let hardware determine CTS value:

```
XACR 6000
DTPG 7
DPGU
// You can read N and CTS value at the reciever for verification.
```

Example 6 Change the N value to 6000, and CTS to 8000:

```
XACR 6000 8000
DTPG 7
DPGU
// You can read N and CTS value at the reciever for verification.
```


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Example 7 Turn audio off:

```
DPTG 3
DPGU
```

Example 8 Turn audio on:

```
DPTG 7
DPGU
```


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DPTG

Data Island Packet Type Gate

Class — Data packet generator

Description — Gates on or off the assigned packet type (Audio Sample, Audio Clock Regeneration, or General Control Packet) to be updated by the hardware and sent to the receiver.

Gating Audio Sample packets on and off also enables and disables the audio output from the transmitter. The mask value is a value ORed with the current setting.

Command syntax — DPTG *mask*

mask

- 1 = General Control Packet (GCP)
- 2 = Audio Clock Regeneration (ACR)
- 4 = Audio Sample
- 8 = Generic Data Packet (GDP)

Related commands — DPGU, DPTR

Example — This example gates off the audio (the current value is 7):

DPTG 3; DPGU

See DPGU for other examples.

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DPTR

Data Island Packet Type Repeat Mask

Class — Data packet generator

Description — Specifies if a General Control packet is sent with every frame or sent once.

Note: *Audio Sample and ACR packets are always enabled (and thus cannot be changed).*

Command syntax — DPTR *mask*

mask

1 = General Control Packet (GCP)

8 = Generic Data Packet (GDP)

Example — See DPGU for examples.

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DSCT

Digital Sync Composite Type

Class — Format parameter setting - Digital video signal

Description — Establishes the type of composite sync that appears at the digital composite sync outputs when digital composite sync is selected via the SSST command. The DSCT? query returns the current setting of DSCT. A setting of zero (0) indicates that digital composite sync cannot be activated by the operator.

Command syntax — DSCT *type*

type

- 0 = none
- 10 = American HDTV w/serr & eq
- 11 = European HDTV w/serr
- 12 = European HDTV w/serr & eq
- 13 = Japanese HDTV ORed
- 14 = Japanese HDTV w/serr
- 15 = Japanese HDTV w/serr & eq

Query syntax — DSCT?

Query response — *type*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
DSCT 2  // Select simple Amer ORed in buffer
FMTU    // Update hardware to current buffer contents
```


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DSST

Digital Sync Separate Type

Class — Format parameter setting - Digital video signal

Description — Establishes the type of digital separate sync that appears at the digital HS and VS outputs of the generator when digital composite sync is selected via the SSST command and the outputs are gated on via the HSPG and VSPG commands. The only difference between EIA and CCIR digital separate syncs is that, in the case of CCIR, the width of the vertical sync pulse is 0.5 line shorter than the width specified via the VSPW command. In the EIA case, the width of the vertical sync pulse is as programmed.

After sending the DSST command, send the FMTU or ALLU command.

Command syntax — DSST *type*

type

- 0 = none
- 1 = American separate
- 2 = American HDTV separate
- 3 = European HDTV separate
- 4 = Japanese HDTV separate
- 5 = European separate

Query syntax — DSST?

Query response — Returns the current setting of DSST. A setting of zero (0) indicates that separate digital H&V sync cannot be activated by the operator.

Example

```
DSST 1
FMTU  // Update hardware to current buffer contents
```


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DVIC

Digital Video Identification Code

Class InfoFrame Generator (IFG) parameter

Description Writes the specified Video Identification Code (VIC) into the AVI InfoFrame.

Command syntax DVIC *code*

code

0 = unestablished format

1 - 34 = DVIC code corresponding to a format defined in EIA/CEA-861-B standard (Section 4). See table below for DVIC codes.

Note: *For detailed information about these timings, refer to the Quantum Data Web site at: http://www.quantumdata.com/support/downloads/802bt/hdmi/TimingsEIA-861-B.pdf.*

DVIC	Format Name	NCPP[1]	SXAR[2]	SXEX[2]	CXAR[2]	TUNE[3]	HRES[4]	VTOT[5]
1	DMT0659	1	A	N_0	A	1	640	525
1	DMT0660	1	A	N_0	A	0	640	525
2	480p59	1	A	N_0	A	1	720	525
2	480p60	1	A	N_0	A	0	720	525
2	480p59LH	1	A	L_{cbb}	H	1	720	525
2	480p60LH	1	A	L_{cbb}	H	0	720	525
3	480p59SH	1	A	S	H	1	720	525
3	480p60SH	1	A	S	H	0	720	525
4	720p59	1	H	N_0	H	1	1280	750
4	720p60	1	H	N_0	H	0	1280	750
5	1080i29	1	H	N_0	H	1	1920	1125
5	1080i30	1	H	N_0	H	0	1920	1125
6	480i2x29	2	A	N_0	A	1	720	525
6	480i2x30	2	A	N_0	A	0	720	525
6	480i2xL1	2	A	L_{cbb}	H	1	720	525
6	480i2xL2	2	A	L_{cbb}	H	0	720	525
7	480i2xS1	2	A	S	H	1	720	525
7	480i2xS2	2	A	S	H	0	720	525
8	240p2x_1	2	A	N_0	A	1	720	262
8	240p2x_2	2	A	N_0	A	0	720	262
8	240p2x_3	2	A	N_0	A	1	720	263
8	240p2x_4	2	A	N_0	A	0	720	263
8	240p2xL1	2	A	L_{cbb}	H	1	720	262
8	240p2xL2	2	A	L_{cbb}	H	0	720	262
8	240p2xL3	2	A	L_{cbb}	H	1	720	263
8	240p2xL4	2	A	L_{cbb}	H	0	720	263
9	240p2xS1	2	A	S	H	1	720	262
9	240p2xS2	2	A	S	H	0	720	262
9	240p2xS3	2	A	S	H	1	720	263
9	240p2xS4	2	A	S	H	0	720	263
10	480i4x29	1	A	N_0	A	1	2880	525

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DVIC	Format Name	NCPP[1]	SXAR[2]	SXEX[2]	CXAR[2]	TUNE[3]	HRES[4]	VTOT[5]
10	480i4x30	1	A	N_0	A	0	2880	525
10	480i4xL1	1	A	L_{cbb}	H	1	2880	525
10	480i4xL2	1	A	L_{cbb}	H	0	2880	525
11	480i4xS1	1	A	S	H	1	2880	525
11	480i4xS2	1	A	S	H	0	2880	525
12	240p4x_1	1	A	N_0	A	1	2880	262
12	240p4x_2	1	A	N_0	A	0	2880	262
12	240p4x_3	1	A	N_0	A	1	2880	263
12	240p4x_4	1	A	N_0	A	0	2880	263
12	240p4xL1	1	A	L_{cbb}	H	1	2880	262
12	240p4xL2	1	A	L_{cbb}	H	0	2880	262
12	240p4xL3	1	A	L_{cbb}	H	1	2880	263
12	240p4xL4	1	A	L_{cbb}	H	0	2880	263
13	240p4xS1	1	A	S	H	1	2880	262
13	240p4xS2	1	A	S	H	0	2880	262
13	240p4xS3	1	A	S	H	1	2880	263
13	240p4xS4	1	A	S	H	0	2880	263
14	480p2x59	2	A	N_0	A	1	720	525
14	480p2x60	2	A	N_0	A	0	720	525
14	480p2xL1	2	A	L_{cbb}	H	1	720	525
14	480p2xL2	2	A	L_{cbb}	H	0	720	525
15	480p2xS1	2	A	S	H	1	720	525
15	480p2xS2	2	A	S	H	0	720	525
16	1080p59	1	H	N_0	H	1	1920	1125
16	1080p60	1	H	N_0	H	0	1920	1125
17	576p50	1	A	N_0	A	0	720	625
17	576p50LH	1	A	L_{cbb}	H	0	720	625
18	576p50SH	1	A	S	H	0	720	625
19	720p50	1	H	N_0	H	0	720	750
20	1080i25	1	H	N_0	H	0	1920	1125
21	576i2x25	2	A	N_0	A	0	720	625
21	576i2xLH	2	A	L_{cbb}	H	0	720	625
22	576i2xSH	2	A	S	H	0	720	625
23	288p2x_1	2	A	N_0	A	0	720	312
23	288p2x_2	2	A	N_0	A	0	720	313
23	288p2x_3	2	A	N_0	A	0	720	314
23	288p2xL1	2	A	L_{cbb}	H	0	720	312
23	288p2xL2	2	A	L_{cbb}	H	0	720	313
23	288p2xL3	2	A	L_{cbb}	H	0	720	314
24	288p2xS1	2	A	S	H	0	720	312
24	288p2xS2	2	A	S	H	0	720	313
24	288p2xS3	2	A	S	H	0	720	314
25	576i4x25	1	A	N_0	A	0	2880	625
25	576i4xLH	1	A	L_{cbb}	H	0	2880	625
26	576i4xSH	1	A	S	H	0	2880	625
27	288p4x_1	1	A	N_0	A	0	2880	312
27	288p4x_2	1	A	N_0	A	0	2880	313
27	288p4x_3	1	A	N_0	A	0	2880	314
27	288p4xL1	1	A	L_{cbb}	H	0	2880	312
27	288p4xL2	1	A	L_{cbb}	H	0	2880	313
27	288p4xL3	1	A	L_{cbb}	H	0	2880	314
28	288p4xS1	1	A	S	H	0	2880	312

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DVIC	Format Name	NCPP[1]	SXAR[2]	SXEX[2]	CXAR[2]	TUNE[3]	HRES[4]	VTOT[5]
28	288p4xS2	1	A	S	H	0	2880	313
28	288p4xS3	1	A	S	H	0	2880	314
29	576p2x50	1	A	N_0	A	0	720	625
29	576p2xLH	2	A	L_{cbb}	H	0	720	625
30	576p2xSH	2	A	S	H	0	720	625
31	1080p50	1	H	N_0	H	0	1920	1125
32	1080p23	1	H	N_0	H	1	1920	1125
32	1080p24	1	H	N_0	H	0	1920	1125
33	1080p25	1	H	N_0	H	0	1920	1125
34	1080p29	1	H	N_0	H	1	1920	1125
34	1080p30	1	H	N_0	H	0	1920	1125

1. The generator treats double-clocking and pixel repetition as two totally separate items. NCPP controls the number of clocks per pixel, while NPPP controls pixel repetition factor. All library formats set pixel repetition factor NPPP to zero (i.e. OFF) by default. Double-clocking and pixel repetition cannot be applied simultaneously due to AVI:RP field constraints. Therefore, double-clocked formats do not support pixel repetition. Pixel repetition is only applicable to the "4x" formats, where HRES remains at 2880-pixels as the pixel repetition factor NPPP is varied between 1 and 10 - thereby varying the effective resolution.
2. EXCX and EXAR are not listed here, because all library formats set EXCX and EXAR equal to N0 and CXAR, respectively. These values may be subsequently changed by rendering a special test image called "AFDtest", after the base format has finished loading, in order to evaluate different AFD cases.
3. TUNE is a flag that indicates whether the frequencies of a format have been detuned or not. A value of one indicates that all of the frequencies of a format have been tuned by a factor of 1/1.001 for NTSC compatibility. A value of zero, on the other hand, indicates that the format has not been so tuned.
4. Double-clocked formats have the same horizontal resolution as single-clocked formats - the horizontal active (as we define it), is not doubled in the double-clocked case. Some formats are distinguished by a horizontal active that is 4-times the normal value of 720. Here, pixel repetition may be applied, by a special "PixelRep" test image, after the format has loaded. The "PixelRep" test image allows the number of pixels-per-pixel (NPPP) to be varied and an image with repeated pixels to be rendered for test purposes.
5. Some formats are distinguished by having a slightly different vertical line total.

Related commands XAVI (see VIC parameter),

Example
```
DVIC 23
FMTU
```


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DVPT

Digital Video Protocol Type

Class — Format parameter setting - Digital video signal

Description — Controls the output protocol. Setting the DVPT parameter to 2 and issuing a FMTU (or ALLU) command causes the output signal protocol to switch to HDMI, while setting DVPT to 1 causes a DVI compatible protocol to be output. All of the formats in the format library set DVPT to 0. This is a default setting, which lets the output protocol be determined, on a global basis, by the type of hardware that is present.

Command syntax — DVPT *type*

type

0 = default (based on hardware present)

1 = DVI 1.0

2 = HDMI 1.0

Example

```
DVPT 2
FTMU
```


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DVQM

Digital Video Quantization Mode

Class — Format parameter setting - Digital video signal

Description — Controls the gamut of digital signals per the EIA/CEA-861-B standard.

The DVQM? query returns the current DVQM mode.

Command syntax — DVQM *mode*

mode

Use the following table to determine the proper mode (0, 1, or 2).

DVQ Mode	Components	NBPC=8 gamuts		NBPC=10 gamuts		NBPC=12 gamuts	
		LMIN	LMAX	LMIN	LMAX	LMIN	LMAX
0	RGB	0	255	0	1023	0	4095
	YC_bC_r	0	255	0	1023	0	4095
1	RGB	1	254	4	1019	16	4079
	YC_bC_r	1	254	4	1019	16	4079
2	RGB	16	235	64	940	256	3760
	YC_bC_r	16	240	64	960	256	3840

Notes:

- Computer (for example, DMT and CVT) formats set DVQM=0 for full gamut.
- DVQM can be set to 1 to test the undershoot/overshoot signal code margins (for example, see SMPTE 296M section 7.12).
- Television formats (for example, 1080i29) set DVQM=2 for reduced gamut required by various television standards (for example, EIA/CEA-861-B).

Query syntax — DVQM?

Example

```
DVQM 1
FMTU
```

Related commands — LMIN, LMAX, NBPC

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DVSC

Digital Video Swing Calibration factor

Class
System calibration setting

Description
Sets the TMDS differential swing calibration factor for the digital video signal (HDMI and DVI). The DVSC query returns the current value.

Command syntax
DVSC *factor*

factor
0.0 to 1.1

Query syntax
DVSC?

Related commands
DVSS

Examples
```
DVSC 0.9   // sets the digital video swing calibration to 0.9
ALLU
```


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DVSI

Digital Video Signal Interface

Class — Format parameter setting - Digital video signal

Description — Determines which of the three interfaces on the 802R-PCI-D generator the digital output is applied. There are three digital interfaces on this PCI generator: LVDS, TTL and DVI.

Command syntax — DVSI *interface*

interface

1 = TTL

2 = LVDS

3 = DVI

Query syntax — DVSI?

Example

```
DVSI 3   // Puts the generator digital output on the DVI interface
ALLU     // Applies the setting to the generator
```


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DVSM

Digital Video Sampling Mode

Class — Format parameter setting - Digital video signal

Description — Controls how the color difference components (CbCr) are sampled when YCbCr signal type is selected. Set DVST to a signal type that supports the sampling mode specified by DVSM.

Command syntax — DVSM *mode*

mode

0 = RGB 4:4:4 (default)

2 = 4:2:2 (color difference components are sampled at half the pixel rate; luminance is sampled at full pixel rate)

4 = 4:4:4 (both luminance and color difference components are sampled at the pixel rate)

Related commands — NBPC, DVST

Examples

```
DVST 10
DVSM 0
FMTU


DVST 13
DVSM 2
FMTU
```


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DVSP

Digital Video Signal Polarity

Class — Format parameter setting - Digital video signal

Description — Establishes the logic sense of the digital video outputs. The DVSP? query returns the current setting of DVSP.

Command syntax — DVSP *polarity*

polarity

0 = active-low (negative going video)

1 = active-high (positive going video)

Query syntax — DVSP?

Query response — *polarity*

Other required commands — To use the digital video outputs, digital video must be enabled with the DVST command. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
AVST 0  // Deselect analog video in buffer
DVST 5  // Select 3 bit color in buffer
DVSP 1  // Select active high video in buffer
FMTU    // Update hardware to current buffer contents
```


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DVSS

Digital Video Signal Swing

Class
Format parameter setting - Digital video signal

Description
Sets the TMDS differential swing voltage for the digital video signal. The DVSS query returns the current value.

The DV_Swing image can also be used to adjust the digital swing.

Command syntax
DVSS *voltage*

voltage
0.0 to 2.0 volts differential peak-to-peak (nominally 1.000, 0.150 to 1.560 range guaranteed)

Query syntax
DVSS?

Related commands
DVST, DVSC

Examples
```
DVSS 1.25   // sets the digital video signal swing voltage to 1.25 volts
ALLU
```


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DVST

Digital Video Signal Type

Class — Format parameter setting - Digital video signal

Description — Establishes the kind of video signal that exits the digital video signal outputs of the generator.

The DVST? query returns the current setting of DVST.

Command syntax — DVST *type*

type

0 = none

10 = RGB

13 = YCbCr (per SMPTE 260M-1999, Table 1)

14 = YCbCr (per ITU-R BT.601-5 Table 3, Item 7)

15 = YCbCr (per ITU-R BT.709-5 Part 1, Section 6.10)

Query syntax — DVST?

Related commands — AVST must be set to zero when digital video is used. Use the ALLU or FMTU command, after the DVST command, to update the hardware with the new settings.

Example

```
AVST 0   // Deselect analog video in buffer
DVST 10  // Select digital RGB
FMTU     // Update hardware to current buffer contents
```


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DWEL

slider image DWELl time

Class — Image Control – System Level

Description — Sets the how long each step of the SlideG and SlideRGB built-in images is displayed before the image is updated. The delay is based on the number of vertical frame refreshes that must occur for the currently loaded video format. The command is also used to set how long each step of the Regulate image is displayed. The DWEL? query returns the current DWELL setting.

Command syntax — DWEL *delay*

delay
integer representing number of video frames

Query syntax — DWEL?

Query response — *delay*

Example

```
DELX 8         // Set H shift to 8 pixels per step
DELY 3         // Set V shift to 3 pixels per step
DWEL 2         // Display each step for 2 frames
IMGL "SlideG" // Select Image that uses DELX and DELY
IMGU           // Draw the Image
```


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EDID?

EDID read

Class EDID and DDC control

Description Reads all bytes in the base EDID and up to seven extensions from a DDC compliant display connected to the transmitter on the generator. The data is returned in raw ASCII hex format.

Query syntax EDID?

Query response ASCII hex test string

Related commands I2CR?

Example This example reads a four block E-EDID.

```
R:\edid?
00FFFFFFFFFFFF004489B200050000000D0C010380502D780A0DC9A05747982712484C200
000010101010101010101010101010101011D8018711C1620582C2500C48E2100009E8C
0AD08A20E02D10103E9600138E21000018000000FC0048444D492054560A2020202020000
000FD003B3D0F2E08000A2020202020200306F00202000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000
C02031CF14985040802010614121623090707830100006503 0C001000011D007251D01E20
6E285500C48E2100001ED60980A020E02D1010602200128E210000188C0AD090204031200
C405500C48E21000018011D80D0721C1620102C2580C48E2100009E8C0AA01451F0160026
7C4300138E2100009800000000000000000A4020308F1431113158C0AD090204031200C4
05500138E21000018011D00BC52D01E20B8285540C48E2100001E8C0AA02051201810187E
2300C48E2100009800000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000
71
```


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EQUA

EQUalization interval After vertical sync pulse

Class
Format parameter setting - synchronization

Description
Establishes the width of the equalization interval after the vertical sync pulse in each field whenever a serrated and equalized sync type is selected via either ASCT or DSCT commands and selected via the SSST command. If the type specified for the selected sync signal is one of the CCIR types, then the actual equalization interval output by the generator will be 0.5 lines shorter than the whole number specified. The EQUA? query returns the current setting of EQUA.

Command syntax
EQUA *lines*

lines
min = 0

max = number of lines after vertical sync before video

Query syntax
EQUA?

Query response
lines

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
EQUA 3  // Set post-equalization to 3 lines in buffer
FMTU    // Update hardware to current buffer contents
```


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EQUB

EQUalization interval Before vertical sync pulse

Class — Format parameter setting - synchronization

Description — Establishes the width of the equalization interval before the vertical sync pulse in each field whenever a serrated and equalized sync type is selected via either ASCT or DSCT commands and selected via the SSST command. If the type specified for the selected sync signal is one of the CCIR types, then the actual equalization interval output by the generator will be 0.5 lines shorter than the whole number specified. The EQUB? query returns the current setting of EQUB.

Command syntax — EQUB *lines*

lines

min = 0

max = number of lines after video and before vertical sync

Query syntax — EQUB?

Query response — *lines*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
EQUB 3  // Set pre-equalization to 3 lines in buffer
FMTU    // Update hardware to current buffer contents
```


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EQUF

EQUalization Flatten

Class — Format parameter setting - synchronization

Description — Determines if composite sync will have all equalization pulses removed in the vertical sync front porch (delay) period as required by certain military HOBO and Maverik video formats. The EQUF? query returns the current setting of EQUF.

Command syntax — EQUF *mode*

mode

0 = OFF

1 = ON

Query syntax — EQUF?

Query response — *mode*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
EQUF 0; ALLU  // This is the default
```


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ERRC

ERRor queue Clear

Class	System error control
Description	Clears all errors waiting to be reported in the error queue.
Command syntax	ERRC

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ERRQ?

ERRor Queue

Class
System error control

Description
Returns number errors from the list of all errors in the error queue beginning at index. The ERRQ? query does not remove the errors from the queue.

Command syntax
ERRQ? *index number*

index
Positive integer number

number
Positive integer number

Query response
List of specified range of errors in the error queue.

Examples:
```
ERRQ? 1 5     // List the first five errors in the queue
```
or
```
ERRQ? 1 9999  // List all errors in the queue
```


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ERRY?

Yank ERRor from queue

Class	Format parameter setting - synchronization
Description	Returns the most recent error added to the error queue and removes it from the queue.
Query syntax	ERRY?
Query response	Error

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EXAR

EXtended Aspect Ratio

Class — Format parameter setting - HDMI active video

Description — Sets the aspect ratio of the extended image content.

Note: *If the source image content was shot for a single screen shape, then this parameter will be the same as the CXAR parameter. Alternatively, if the source image content was shot for two different shaped screens (using a "shoot and protect" technique), then this parameter will be different than the CXAR parameter.*

Command syntax — EXAR *aspect_ratio*

aspect_ratio
0.75 to ˜2.39

Note: *For a listing of established aspect ratios, see the table on page 262 (CXAR command).*

Related commands — CXAR, SXAR

Example —
```
EXAR 1.77 // Sets 16:9 picture aspect ratio for extended image content
FMTU
```


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EXCX

Extended-From-Content Aperture Map

Class — Format parameter setting - HDMI active video

Description — Maps CXAR-shaped image content into the extended EXAR-shaped aperture.

Command syntax — EXCX *code*

code

0 to 131071 (in decimal)

The mapping code is made up of three binary field codes as follows:

- Bits 0-2 are the *Squeeze/Stretch* (“S”) field code
- Bits 3-9 are the *Letterbox/Pillar* (“L”) field code
- Bits 10-16 are the *Safe Area* (“K”) field code

To determine the proper mapping code, follow these steps:

1. Using the table below, determine the proper “S” field code for bits 0-2.

Squeeze/Stretch Method	“S” Field Code			Symbol
	Undo	Non-Linear	Squeeze	
	Bit 2	Bit 1	Bit 0	
Disabled (scaling is uniform)	0	0	0	
Linear Squeeze (anamorphise)	0	0	1	S

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2. Using the table below, determine the proper “L” field code for bits 3-9.

Letterbox/Pillar Mode	“L” Field Code							Symbol
	Undo	Bars	BarContents		Position		Shrink	
	Bit 9	Bit 8	Bit 7[1]	Bit 6[1]	Bit 5	Bit 4	Bit 3	
Disabled	0	0	0	0	0	0	0	
Centered shrink w/black bars top & bottom	0	1	0	0	0	0	1	Lcbb
Centered shrink w/gray bars top & bottom	0	1	0	1	0	0	1	Lcgb
Centered shrink w/white bars top & bottom	0	1	1	0	0	0	1	Lcwb
Centered protected shrink w/shot surround	0	0	0	0	0	0	1	Lcsp
Top shrink w/single black bar at bottom	0	1	0	0	0	1	1	Ltbb
Top shrink w/single gray bar at bottom	0	1	0	1	0	1	1	Ltgb
Top shrink w/white bar at bottom	0	1	1	0	0	1	1	Ltwb

1. Bits 6 and 7 are used to sequence redundant AFD codes.

In the case of pixel repetition (NPPP not equal to 0), the color of the (extended) bars on the left and right sides of the image are filled in accordance with the settings of bits 6 and 7—even when the letterbox/pillar fitting method is disabled (bit 3 = 0).

3. Use the following table to determine the proper “K” field code for bits 10-16.

(Keep) Safe Area Mode	“K” Field Code							Symbol
	Undo	Bars	BarContents		Source	Save Area		
	Bit 16	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	
None (w/safe area markers)	0	0	0	0	0	0	0	
Shrink coded frame to action area with opaque black bar surround	0	1	0	0	0	0	1	Kabb
Shrink coded frame to action area with opaque gray bar surround	0	1	0	1	0	0	1	Kagb
Shrink coded frame to action area with opaque white bar surround	0	1	1	0	0	0	1	Kawb
Coded frame has shot-protected action area without graticules or bars	0	0	0	0	0	0	1	Kasp
Coded frame has shot-protected action area with action graticules without bars	0	0	0	1	0	0	1	Kaspa
Coded frame has shot-protected action area with title graticules without bars	0	0	1	0	0	0	1	Kaspt
Coded frame has shot-protected action area with action and title graticules without bars	0	0	1	1	0	0	1	Kaspb
Shrink coded frame to title area with opaque black bar surround	0	1	0	0	0	1	0	Ktbb
Shrink coded frame to title area with opaque gray bar surround	0	1	0	1	0	1	0	Ktgb

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(Keep) Safe Area Mode	"K" Field Code							Symbol
	Undo	Bars	BarContents		Source	Save Area		
	Bit 16	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	
Shrink coded frame to title area with opaque white bar surround	0	1	1	0	0	1	0	Ktwb
Coded frame has shot-protected title area without graticules or bars	0	0	0	0	0	1	0	Ktsp
Coded frame has shot-protected title area with action graticules without bars	0	0	0	1	0	1	0	Ktspa
Coded frame has shot-protected title area with title graticules without bars	0	0	1	0	0	1	0	Ktspt
Coded frame has shot-protected title area with action and title graticules without bars	0	0	1	1	0	1	0	Ktspb
Coded frame has shot-protected custom area with-out graticules or border	0	0	0	0	0	1	1	Kcsp
Coded frame has shot-protected custom area with action graticules without border	0	0	0	1	0	1	1	Kcspa
Coded frame has shot-protected custom area with title graticules without border	0	0	1	0	0	1	1	Kcspt

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The following table provides mapping codes used by AFD (see XAFD).

Method	Binary Field Code	Decimal Code	Symbol
Natural aspect ratio	00000000000000000	0	N0
	00000000000010000	16	N1
	00000000000100000	32	N2
Squeeze (anamorphise)	00000000000000001	1	S
Centered protected shrink with shot surround	00000000000001000	8	Lcsp
Centered shrink with black bars top and bottom	00000000100001000	264	Lcbb
Top shrink with single black bar at bottom	00000000100011000	280	Ltbb
Shrink coded frame to title area w/ opaque black bar surround	01000100000000000	34816	Ktbb

Related commands CXAR, EXAR, SXCX, SXEX

Example
```
EXCX 8 // Use centered protected shrink w/shot surround mode
FMTU
```


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FDTA

Font DaTA

Class

Description

Writes font data. It takes as arguments *table* (the table from which to read), *index* (the index of the item within the table), and *value* (the data to be written to the table).

The FDTA? query reads font data. It takes as arguments *table* (the table from which to read) and *index* (the index of the item within the table). It returns *value* (the data to be written to the table).

The *table* argument must be one of the following:

- 0 = The header, treated as an uint16[ ].
- 1 = The character pattern, an uint32[ ].
- 2 = The location table, an uint16[ ].
- 3 = The offset/width table, an uint16[ ].
- 4 = The image width table, an uint8[ ].

Note: *The index range for table #0 must be: 0 = index 13. The index range for the other tables depends on the font size.*

Command syntax

FDTA *table index value*

table
positive integer number

index
positive integer number

value
positive integer number

Query syntax

FDTA? *table index*

table
positive integer number

index
positive integer number

Related commands

FDTA

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FLSH

FLaSH new firmware via GPIB

Class — System Level

Description — Changes the firmware in the generator's flash EPROM via the GPIB port. This is accomplished by sending an IEEE 488.2 standard arbitrary block program data to the generator. The generator temporarily places the block in picture memory and, if received intact, eventually transfers the binary image to flash memory by internally executing the VTOF function. Note that one does not have to send VTOF after a FLSH transfer.

FLSH initiates the data transfer. An *arbitrary_block_program_data* argument containing either 512K or 2M bytes of binary data should follow this command per standard IEEE-448.2 section 7.7.6 GPIB data transfer methods.

Command syntax — FLSH *arbitrary_block_program_data*

arbitrary_block_program_data

IEEE-488.2 arbitrary block program data per standard IEEE-448.2 section 7.7.6 GPIB data transfer method. The maximum number of bytes sent depends on the generator: 801requires a maximum of 524288 bytes, while 802 requires a maximum of 2097152 bytes.

Related commands — YMDI, VTOF

Example — `FLSH #6524288 …EPROM data bytes…`

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FMTA

ForMaT save As

Class Format memory management

Description Saves the current contents of the format edit buffer using the given name

Command syntax FMTA *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Example
```
FMTA MY_FMT  // Save with the name "MY_FMT"
```


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FMTB

ForMaT editing Begin

Class — Format editor control

Description — Marks the beginning of a format editing session.

Command syntax — FMTB

Other required commands — Use either an FMTL command to load an existing image or an FMTN command to create a new format. Use FMTE when ending the editing session.

Example

```
FMTN  // Initialize format edit buffer
FMTB  // Start format editing session

      // One or more format editing commands ...

FMTE  // End format editing session
```


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FMTE

ForMaT editing End

Class — Format editor control

Description — Marks the end of a format editing session.

Command syntax — FMTE

Other required commands — Use FMTB when starting the editing session. Use FMTA or FMTS to save changes.

Example

```
FMTB           // Start format editing session

               // One or more format editing commands ...

FMTA My_fmt1   // Save edited format as My_fmt1
FMTE           // End format editing session
```


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FMTG?

ForMaT in buffer Good

Class — Format memory management

Description — Tests the format in the format buffer for errors. If no errors are found, FMTG? returns zero. Otherwise, if one or more errors exist, the number of the first error encountered is returned. To test formats residing in format memory, use the FMTT? query.

Query syntax — FMTG?

Query response — Returns 0 if no errors are found; otherwise, returns the number of the first error encountered.

Example

```
FMTG?  // Return format error status
```


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FMTJ

ForMaT Justify

Class — Format memory management

Description — Corrects some types of timing errors for the current data in the format buffer. The following errors are corrected:

- Pixel Rate errors 2071 and 2072
- Video Memory Size error 2550
- Horizontal Blanking errors 2140, 2141, 2150 and 2155
- Horizontal Total errors 2090 and 2091
- Horizontal Sync Pulse Width errors 2181 and 2201

The justification routine tries to keep the format close to your original specifications. However, the format should be reviewed after it is justified to make sure it still meets your timing requirements.

Command syntax — FMTJ

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates hardware to the new settings and redraws the test image. The FMTG? query can be used to see if any errors remain.

Example

```
FMTJ
FMTU  // Update hardware to current buffer contents
```


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FMTK

ForMaT Kill from memory by name

Class
: Format memory management

Description
: Erases the named format from memory. The FMTK? query checks to see if the named format can be erased. The RAM location number is returned if it can be erased. Otherwise, a zero is returned.

Command syntax
: FMTK *name*

name
: a valid MS-DOS filename (8 characters minus any extension)

Query syntax
: FMTK? *name*

name
: valid MS-DOS filename (8 characters minus any extension)

Query response
: 0 or location

Example
: `FMTK my_fmt1  // Erase format called my_fmt1`

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FMTL

ForMaT Load from memory by name

Class
Format memory management

Description
Assigns a format to the current step of a sequence while between a set of SEQB and SEQE commands. The FMTL command is context sensitive. The FMTL? query returns the name of the format currently assigned to the step.

Outside of the sequence editor, the FMTL command reads the format having a name equal to name from format memory (or EPROM) into the format. FMTL does not reconfigure the signal generating hardware. This feature allows you to work on the contents of any format memory location, while continuing to output a signal based on a previously used format (see FMTU command). The FMTL? query returns the location location in which a format having a name equal to name is found. If multiple formats exist having name *name*, then the lowest numbered location containing a format with a matching name *name* is returned. The format memory (RAM) is always searched first. If a format with name *name* cannot be found anywhere in the format memory, then the industry-standard formats located in EPROM (negative locations) are searched next.

The FMTL? query returns zero if a format with a name equal to name cannot be found in either format space.

Command syntax
FMTL *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax
FMTL? *name*

Query response
location (returns 0 if not found)

Other required commands
The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
FMTL VGA_m3  // Load format called VGA_m3
ALLU         // Update hardware and redraw image
```


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FMTN

ForMaT New

Class Format memory management

Description Initializes the format editing buffer. Sending this one command is equivalent to sending all of the following commands:

ASBG 0
ASCT 1
ASGG 1
ASSG 0, 1, 0
ASSS 0.286
AVPG 0
AVPS 0.0
AVSB 0.0
AVSS 0.714
AVST 0
XVSG 1, 1, 1
CSPG 1
CSPP 0
DCBM 0
DSEX 0
DSST 1
DVSP 0
DVST 0
EQUA 0
EQUB 0
GAMA 2.2
GAMC 0
HRAT 0
HRES 0
HSIZ 280
HSPD 0
HSPG 1
HSPP 0
HSPW 0
HTOT 0
SCAN 1
SSST 1
USIZ 2
VRES 0
VSIZ 210
VSPD 0
VSPG 1
VSPP 0
VSPW 0
VTOT 0

This should be the first command sent to the generator when creating a new format. The command only resets to a known state. The command does not create a usable format. The FMTN? query returns the current name of the format in the buffer.

Command syntax FMTN *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax FMTN?

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Query response *name*

Example

```
FMTN  // Initialize format buffer
```

or

```
FMTN Narf  // Initialize format buffer and name the format "Narf"
```


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FMTP

ForMaT Path

Class — Format memory management

Description — Sets the current format path name to a given directory. The query will return the current format path name.

Command syntax — FMTP *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — FMTP?

Query response — *name*

Example

```
DIRQ?          // List directory objects
FMT
IMG
VGA_FMTS
SEQ

FMTP VGA_FMTS // Load a custom format knob list

FMTP FMT      // Load the default format knob list
```


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FMTQ?

ForMaT Query pointer

Class — Format memory management

Description — Returns number format names from the list of all the formats stored in format memory beginning at index. The formats are kept in alphanumeric order. The generator maintains internal variables for the current index and number values. The value of index is automatically incremented by number after the query is executed. Sending the query with just an index parameter returns the same number of names as the last time, starting at the given index. Sending the query with no parameters, returns the next set of names.

Query syntax — FMTQ? [*index* [*number*]]

index
positive integer number

number
positive integer number

Query response — List of specified format names

Example

```
FMTQ? 1 9999  // List all formats in memory
```

or

```
FMTQ? 1 10    // List the first ten formats in memory
FMTQ? 21      // List the 21st through the 30th FMTes in memory
FMTQ?         // List the 31st through the 40th FMTes in memory
```


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FMTR

ForMaT Read from memory location (by number)

Class
Format memory management

Description
Reads format from the format memory location into the format buffer. The FMTR command does not reconfigure the signal generating hardware. The FMTR? query returns the name of the format stored in location *location*. FMTR? returns the string EMPTY if the format memory location *location* is empty.

Command syntax
FMTR *location*

location

1 through 300 (RAM)

-1 through -24 (EPROM)

Query syntax
FMTR? *location*

Query response
name

Other required commands
The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
FMTR -5  // Load format from ROM location 5
ALLU     // Update hardware and redraw image
```


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FMTS

ForMaT Save

Class Format memory management

Description Saves the current format edit buffer contents into format memory using the current name of the format in the edit buffer.

Command syntax FMTS

Example

```
FMTL DMT0660  // Loads a format for editing
FMTB          // Begins and editing session
HRES 654      // Sets the horizontal resolution to 654 pixels
.
.             // other format parameters
.
HTOT 720      // Sets the horizontal total to 720 pixels
FMTE          // Ends the format editing session
FMTS          // Saves format
```


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FMTU

ForMaT Use

Class — Format memory management

Description — Checks the current contents of the format buffer for errors; if no errors are found, it reconfigures the signal generating hardware in accordance with the contents. It does not redraw the previously displayed test image. In some cases this may distort the old image.

The FMTU? query returns either a format memory location *location* or zero. If the signal format currently being output by the signal generating hardware matches that originally loaded (using the FMTL command) or read (using the FMTR command) from a format memory location, then the matching format memory location *location* is returned. Otherwise, if the format contents have been used to update the signal generating hardware since either an FMTR or FMTL command has been issued, then FMTU? query returns zero.

Command syntax — FMTU

Query syntax — FMTU?

Query response — location or 0

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FMTZ

ForMat Zap

Class — Format memory management

Description — Clears format storage memory starting at first and ending at last. The cleared locations are then tagged as being empty. If no last parameter is given, only the first location is cleared. The FMTZ? query is used to determine if a location contains a format or is empty.

Command syntax — FMTZ *first last*

Query syntax — FMTZ? *location*

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FORM

draw FORMat data block

Class
Custom image primitive

Description
Displays basic information about the format driving the display. The first line shows the number of horizontal active pixels and vertical active lines. The last number on the line is the number of fields per frame (1 for non-interlaced and 2 for interlaced). The second and third lines show the horizontal and vertical rates, respectively. Text is on a black rectangular background with a single pixel border.

FORM uses three (3) parameters. The first is the color of the text and border. The next two are the X and Y coordinates for the top left corner of the block of text.

Command syntax
FORM *color x y*

color
available colors

x
positive integer number

y
positive integer number

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
FORM blue 30 200  // Display format information
                  // in blue beginning at X=30, Y=200
ALLU              // Update hardware to current buffer contents
```


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FRAT?

Frame RATe Query

Class	Format parameter setting - Video resolution
Description	Returns the current frame (vertical) rate setting.
Query syntax	FRAT?
Query response	frame rate
Example	`FRAT?` `25.0000`
Related commands	TMAU

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FRGB

Foreground Red, Green and Blue levels

Class — System parameter settings

Description — Temporarily sets the portions of an image drawn with a color selection of foreground to the given red, green and blue values. All three colors can be set to the same level using a single parameter. The color selection for one or more primitives in a custom image must be set to foreground in order to see the affect of this command on a custom image. The setting is not global and is not saved. The FRGB? query returns the current red, green and blue settings of FRGB.

Command syntax — FRGB *red_level green_level blue_level*

or

FRGB *common_gray_level*

level

min = 0 (full off)

max = 255 (full on)

Query syntax — FRGB?

Query response — *red_level green_level blue_level*

Example

```
FRGB 255 128 0  // Set foreground color to orange
```

or

```
FRGB 128   // Set foreground color to a mid-gray level
```


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FSPD

Frame Sync Pulse Delay

Class — Format parameter setting - Synchronization

Description — Sets the delay of the frame sync pulse relative to the last line of active video in the current format. The FSPD? query returns the current FSPD setting.

Command syntax — FSPD *delay*

delay

min = 0 lines

max = (VTOT/SCAN) line

Query syntax — FSPD?

Query response — *delay*

Other required commands — To get a pulse, frame sync must first be enabled with the FSPG command. The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
FSPG 1      // Enable Frame Sync
FSPP 1      // Set for positive going pulse
FSPW 20     // Make the pulse 20 pixels wide
FSPG 300    // Pulse to occur 300 lines after
            // the last line of active video
FMTU        // Update hardware to new settings
```


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FSPG

Frame Sync Pulse Gate

Class — Format parameter setting - Synchronization

Description — Enables and disables the digital horizontal sync output. The FSPG? query returns the current FSPG mode.

Command syntax — FSPG *mode*

mode

0 = OFF

1 = ON

Query syntax — FSPG?

Query response — 0 or 1

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
FSPG 1      // Enable Frame Sync
FMTU        // Update hardware to new settings
```


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FSPP

Frame Sync Pulse Polarity

Class — Format parameter setting - Synchronization

Description — Establishes the logic sense of the digital frame sync output. Setting polarity to one (1) causes the leading edge of frame sync to be a low-to-high transition. Setting polarity to zero (0) causes the leading edge of frame sync to be a high-to-low transition. The FSPP? query returns the current polarity of FSPP.

Command syntax — FSPP *polarity*

polarity

0 = active-low (negative going pulse)

1 = active-high (positive going pulse)

Query syntax — FSPP?

Query response — 0 or 1

Other required commands — To get a pulse, frame sync must first be enabled with the FSPG command. The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
FSPG 1      // Enable Frame Sync
FSPP 1      // Set for positive going pulse
FSPW 20     // Make the pulse 20 pixels wide
FSPG 300    // Pulse to occur 300 lines after
            // the last line of active video
FMTU        // Update hardware to new settings
```


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FSPW

Frame Sync Pulse Width

Class — Format parameter setting - Synchronization

Description — Establishes the width of the frame sync pulse. The FSPW? query returns the current setting of FSPW.

Command syntax — FSPW *pixels*

pixels

min = 1

max = HTOT - 1

Query syntax — FSPW?

Query response — *pixels*

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
FSPG 1    // Enable Frame Sync
FSPP 1    // Set for positive going pulse
FSPW 20   // Make the pulse 20 pixels wide
FSPG 300  // Pulse to occur 300 lines after the last line of active video
FMTU      // Update hardware to new settings
```


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GAMA

GAMmA correction factor

Class — Format parameter setting - Digital video signal

Description — Establishes the current video gamma correction factor. The GAMA? query returns the current setting of the gamma correction factor.

Command syntax — GAMA *factor*

factor

min = 0.1 (floating point accepted)

max = 10.0 (floating point accepted)

For HDMI video signals GAMA is always 2.222

Query syntax — GAMA?

Query response — *factor*

Other required commands — Gamma correction must be enabled with the GAMC command in order to use the gamma correction factor. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
GAMC 1    // Enable gamma correction in buffer
GAMA 2.2  // Set correction factor in buffer
FMTU      // Update hardware to current buffer contents
```


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GAMC

GAMma Correction mode

Class — Format parameter setting - Digital video signal

Description — Enables or disables application of the video gamma correction factor. The GAMC? query can be used to determine if the gamma correction factor is currently being applied.

Command syntax — GAMC *mode*

mode

0 = disable (don't correct)

1 = enable (correct)

Query syntax — GAMC?

Query response — 0 or 1

Other required commands — The value used for gamma correction is set with the GAMA command. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
GAMC 1    // Enable gamma correction in buffer
GAMA 2.2  // Set correction factor in buffer
FMTU      // Update hardware to current buffer contents
```


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GCET?

Get Component Error Tallies

Class DVI signal analyzer

Description Reads the number of errors in the red, green, and blue components along with the total number of bad pixels.

Query syntax GCET?

Query response R, G, B, and bad pixels

Example

```
PNAU      //Pseudo-random noise generated

CR        //Stop pseudo-random noise

GCET?
0,21,0,21 //Returns 21 Green pixel errors and a total of 21 bad pixels
```

Related commands PNAU

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GETA?

GET data from Absolute memory location

Class
Direct processor control

Description
Returns the value of the data stored at the memory address specified. Up to 32 bits can be read with this query (see SIZE command). The returned value *value* is formatted according to the current setting of BASE (see the BASE command).

Note: *This command is used only with custom applications and command files created by Quantum Data.*

Query syntax
GETA? address

address

0 to 4,294,967,295 (BASE = 10)

-2,147,483,648 to 2,147,483,647 (BASE = -10)

0 to FFFFFFFF (BASE = 16)

-80000000 to 7FFFFFFF (BASE = -16)

Query response
value

Other required commands
GETAand GETA? expect and return parameters formatted according to the current radix set by the BASE command.

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GETR?

GET data from Relative memory location

Class	Direct processor control
Description	Returns the value of the data stored at the memory location currently pointed to by the address register (see ADDR command). Up to 32 bits can be read with this query (see SIZE command). The returned value *value* is formatted according to the current setting of BASE (see the BASE command). The address register is automatically incremented by SIZE bits after the current location has been read. ***Note:*** *This command is used only with custom applications and command files created by Quantum Data.*
Query syntax	GETR?
Query response	*value*
Other required commands	GETR and GETR? expect and return parameters formatted according to the current radix set by the BASE command.

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GFED?

Get First Error Data

Class DVI signal analyzer

Description Returns information about the first error encountered.

Query syntax GFED?

Query response expected value followed by the errant value (in hex)

Example

```
PNAU  //Pseudo-random noise generated

CR    //Stop pseudo-random noise

GFED? //Returns expected (40018C) and errant (FFFFFF) value of first
errored pixel
40018C,FFFFFF
```

Related commands PNAU

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GLUT

Get LUT from hardware

Class	Lookup Table Memory Management
Description	Copies the current values from the hardware lookup table to the lookup table edit buffer.
Command syntax	GLUT

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GMAP

Get pixel MAP from frame buffer

Class — Bitmap image control

Description — The GMAP command

Command syntax — GMAP *width height x y name*

width

height

x

y

name

Other required commands — The contents of the temporary buffer can not be edited directly. The MAPL command must be used to copy the temporary buffer contents to the edit buffer.

Example

```
GMAP 3 3 5 5 thismap  // get a new map named thismap from frame buffer
MAPL mymap            // load bitmap mymap into edit buffer
MAPB                  // begin map editing context
```


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GNPT?

Get Number of Pixel Tested

Class — Signal analyzer - Pixel data

Description — Returns the number of pixels being measured in billions after a pseudo noise measurement has finished execution (that is, completed the PNAU command).

Query syntax — GNPT?

Query response — number of pixels

Example

```
PNAU //Pseudo-random noise generated

CR //Stop pseudo-random noise

GNPT? //Returns 4.255 billion pixels
4.255
```

Related commands — PNAU

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GPEL?

Get PixEL color components

Class: Signal analyzer - Pixel data

Description: Takes the (x, y) coordinates address of a pixel and returns the red, green, and blue color components of the pixel at that address.

Query syntax: GPEL? *x y*

Query response: R, G, B

Possible errors: Should this info be integrated into the Query response area, instead of creating a new label?The GPEL? query may respond back with one of the following errors in case of a parameter is not set correctly (or in case the setup is not correct).

PNSeedExceedsLimit	2800
PNLengthExceedsLimit	2801
PNNotSupported	2802
NoInputSupported	2803
XcoordOutOfRange	2804
YcoordOutOfRange	2805

Example:

```
PDSX 128      //sets patch starting at x-pixel 128
PDSY 256      //sets patch starting at y-pixel 256
PDSH 64       //sets patch height at 64 pixels
PDSW 96       //sets patch width at 90 pixels
PDAU          //captures patch of image
GPEL? 128 256 //read RGB color components at pixel address 128,256
0,255,0
```

Related commands: PDAU

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GPER?

Get Pixel Error Rate

Class — Signal analyzer - Pixel data

Description — Returns the pixel error rate in errors per billion after a pseudo noise measurement has finished execution (that is, completed the PNAU command).

Query syntax — GPER?

Query response — pixel error rate

Example

```
PNAU   //Pseudo-random noise generated

CR    //Stop pseudo-random noise

GPER? //Returns 0.88 billion pixel errors
0.88
```

Related commands — PNAU

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GPIB

GPIB address

Class
GPIB port control

Description
Sets the address of the generator on the GPIB port. The address change takes affect as soon as the command is issued. The new address setting will be maintained until 1) the address is changed another GPIB command, 2) the unit is re-initialized with an INIT command or 3) the unit is re-initialized because the power-up self-test found corrupted data in battery backed system memory. In cases 2 and 3, the GPIB address will revert to the address set on the GPIB address switches, if the unit has them. The address reverts to 15 if the unit does not have GPIB address switches. The GPIB? query returns the current GPIB address of the unit.

Command syntax
GPIB *address*

address
integer, 0-30

Query syntax
GPIB?

Query response
address

Example
```
GPIB 5  // Set GPIB address to 5
```


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GRID

draw a centered GRID

Class
Custom image primitive

Description
Draws a crosshatch of a given color and forms a given number of boxes in each direction. All lines are 1 pixel thick. All of the lines in a given direction are equally spaced. Any remaining pixels are distributed as equally as possible around the perimeter of the grid. This may cause the first and last lines in each direction not to be at the very edges of video.

Command syntax
GRID *color horizontal_boxes vertical_boxes*

color
available colors

horizontal_boxes
number of horizontal boxes (half of number of pixels)

vertical_boxes
number of vertical boxes (half of number of lines)

Other required commands
The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
GRID gray75 14 10  // Draw a gray75 grid with 14 horizontal
                   // and 10 vertical boxes
ALLU               // Update hardware to current buffer contents
```


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GRIH

draw a GRIll pattern of Horizontal lines

Class
Custom image primitive

Description
Draws equally spaced horizontal lines that form a grill over the entire active video area. The primitive uses three parameters. The first is the color of the lines, the second is the thickness of the lines, and the third is the thickness of the space between the lines.

Command syntax
GRIH *color line_width space_width*

color
available colors

line_width
number of pixels in line

space_width
number of pixels in space

Other required commands
The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
GRIH green 4 6  // Draw green grid with 4-pixel lines and 6-pixel spaces
ALLU            // Update hardware to current buffer contents
```


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GRIV

draw a GRIll pattern of Vertical lines

Class
Custom image primitive

Description
Draws equally spaced vertical lines that form a grill over the entire active video area. The gaps are not touched and will show any previously drawn primitives. The primitive uses three parameters. The first is the color of the lines, the second is the thickness of the lines, and the third is the thickness of the space between the lines.

Command syntax
GRIV *color line_width space_width*

color
available colors

line_width
number of pixels in line

space_width
number of pixels in space

Other required commands
The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
GRIV cyan 16 16  // Draw cyan grill with 16-pixel lines
                 // and 16-pixel spaces
ALLU             // Update hardware to current buffer contents
```


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GRNG

GRNe Gate

Class	Video Gate
Description	Toggles the green video signal gate.
Command syntax	GRNG *mode* *mode* 0 = disable 1 = enable
Query syntax	GRNG?
Query response	0 or 1
Other required commands	ALLU to invoke the command.
Related commands	BLUG, REDG
Example	`GRNG 0; ALLU  // disable green video component`

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GTLS

Go To Local State

Class — System Control

Description — Enables the use of the front panel keys and knobs (local operation) on the unit that may have been previously disabled with the LLOS command. The GTLS? query returns the current state of local operation.

Command syntax — GTLS

Query syntax — GTLS?

Query response — 0 or 1

0 = local state disabled (local lockout enabled)

1 = local state enabled (local lockout disabled)

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HATI

draw a centered crossHATch from the Inside out

Class — Custom image primitive

Description — Draws a crosshatch from the inside-out of a given color and forms a given number of boxes in each direction. The primitive has center lines that divide the active video exactly in half in each direction. The vertical center line is 2 pixels thick if the format has an even number of active pixels. The horizontal center line is 2 pixels thick if the format has an even number of active lines. All other lines are 1 pixel thick. If you enter an odd number of boxes, a half box is placed at each end of the crosshatch. All lines in a given direction are spaced equally. Any remaining pixels are distributed as equally as possible around the perimeter of the grid. This may cause the first and last lines in each direction not to be at the very edges of video. In turn, this may cause any half boxes to be slightly larger.

Command syntax — HATI *color horizontal_boxes vertical_boxes*

color
available colors

horizontal_boxes
number of horizontal boxes (half of number of pixels)

vertical_boxes
number of vertical boxes (half of number of lines)

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HATI green 15 9  // Draw a green grid with 15 horizontal
                 // and 9 vertical boxes
ALLU             // Update hardware to current buffer contents
```


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HATO

draw a centered crossHATch from the Outside in

Class
Custom image primitive

Description
Draws a crosshatch from the outside-in of a given color and forms a given number of boxes in each direction. All lines are 1 pixel thick. The first and last lines in each direction are at the very edges of active video. All the lines in a given direction are spaced equally. Any remaining pixels are added to the boxes along the horizontal and vertical centers of the image.

Command syntax
HATO *color horizontal_boxes vertical_boxes*

color
available colors

horizontal_boxes
number of horizontal boxes (half of number of pixels)

vertical_boxes
number of vertical boxes (half of number of lines)

Other required commands
The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HATO yellow 15 9  // Draw a yellow grid with 15 horizontal
                  // and 9 vertical boxes
ALLU              // Update hardware to current buffer contents
```


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HDCP?

HDCP

Class HDCP

Description: The HDCP query is used to control HDCP tests.

Query syntax HDCP? *[A1 | A2] [B1 | B2] [frames]*

A1
runs the test with public keys A1

A2
runs the test with public keys A2

B1
runs the test with public keys B1

B2
runs the test with public keys B2

frames
The number of frames to be tested. The default is 512.

Example
```
HDCP? 2000          // run test with production keys for 2000 frames
HDCP? a2 b1 2000    // run test with public keys a2, b1 for 2000 frames
```

For additional examples, see “Using command-line interface to control HDCP” on page 190.

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HDMI

High-Definition Multimedia Interface protocol

Class — Digital video signal control

Description — Sets the current digital protocol. Restarting the generator does not change this setting.

The HDMI? query returns the current mode.

Command syntax — HDMI *mode*

mode

0 to disable HDMI (use alternative protocol such as DVI 1.0)

1 to enable HDMI (default)

This command affects the DVPT parameter as shown below:

Interface hardware used	HDMI setting	DVPT setting
DVI only	0	0
	1	2
HDMI	0	1
	1	0

Query syntax — HDMI?

Query response — 0 or 1

Example

```
HDMI 0
ALLU
```


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HRAT

Horizontal RATe

Class — Format parameter setting - Video resolution

Description — Sets the line frequency. Pixel rate is equal to HTOT multiplied by HRAT. Frame rate is equal to HRAT divided by VTOT. Field rate is equal to SCAN multiplied by the frame rate. The HRAT? query returns the current horizontal frequency setting.

Command syntax — HRAT *frequency*

frequency

typical min = 1000 Hz (floating point accepted)

typical max = 130000 Hz (floating point accepted)

Query syntax — HRAT?

Query response — frequency in Hz (floating point returned)

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HRAT 32768  // Set 32.768 kHz rate in buffer
FMTU        // Update hardware to current buffer contents
```

or

```
HRAT 32.768E3  // Set a 32.768 kHz rate
FMTU           // Update hardware to current buffer contents
```


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HRES

Horizontal RESolution

Class — Format parameter setting - Video resolution

Description — Establishes the number of active pixels per line. The HRES? query returns the current setting of HRES.

Command syntax — HRES *pixels*

pixels

min = 16

max depends on VRES and model of generator

Query syntax — HRES?

Query response — *pixels*

Other required commands — The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
HRES 480  // Set 480 active pixels line in buffer
ALLU      // Configure hardware and redraw image
```


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HSIZ

Horizontal SIZe

Class — Format parameter setting - Video resolution

Description — Establishes the horizontal physical size of the image on the display. Units expected (or returned) vary according to the last mode set with USIZ command. The HSIZ command is context sensitive and must appear between begin and end commands FMTB and FMTE. The HSIZ? query returns the current setting of HSIZ.

Note: *Make sure that the USIZ parameter is properly set before using the HSIZ command. Changing the USIZ setting after entering HSIZ will convert the size to match the new unit of measure.*

Command syntax — HSIZ *physical_size*

physical_size
positive value (floating point accepted)

Query syntax — HSIZ?

Query response — Returns physical size (floating point returned)

Other required commands — The units of measure must be properly set by USIZ before entering HSIZ. The ALLU command updates hardware to the new setting and redraws the test image, taking the new size into account.

Example

```
FMTB        // Begin editing session One or more format editing commands
            // ...
USIZ 1      // Select inches as unit of measure in buffer
HSIZ 10.4   // Set width to 10.4 in buffer
VSIZ 7.8    // Set height to 7.8 in buffer
ALLU        // Test the new settings
            // more format editing commands
            // ...
FMTE        // End of editing session
```


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HSPD

Horizontal Sync Pulse Delay

Class — Format parameter setting - Synchronization

Description — Establishes the delay between the leading edge of blanking and the leading edge of the horizontal sync pulse. The HSPD? query returns the current setting of HSPD.

Command syntax — HSPD *pixels*

pixels

min = 1

max = HTOT - HRES - HSPW

Query syntax — HSPD?

Query response — *pixels*

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HSPD 16  // Set 16 pixel pulse delay in buffer
FMTU     // Update hardware to current buffer contents
```


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HSPG

Horizontal Sync Pulse Gate

Class
Format parameter setting - Synchronization

Description
Enables and disables the digital horizontal sync output. The HSPG? query returns the current HSPG mode.

Command syntax
HSPG *mode*

mode
0 = OFF

1 = ON

Query syntax
HSPG?

Query response
0 or 1

Other required commands
To use digital horizontal sync, digital separate H and V sync must be selected with the SSST command. The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HSPG 1  // Enable H sync output in buffer
FMTU    // Update hardware to current buffer contents
```


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HSPP

Horizontal Sync Pulse Polarity

Class — Format parameter setting - Synchronization

Description — Establishes the logic sense of the digital horizontal sync outputs. Setting polarity to 1 causes the leading edge of horizontal sync to be a low-to-high transition. Setting polarity to 0 causes the leading edge of horizontal sync to be a high-to-low transition. The HSPP? query returns the current polarity of HSPP.

Command syntax — HSPP *polarity*

polarity

0 = active-low (negative going pulse)

1 = active-high (positive going pulse)

Query syntax — HSPP?

Query response — 0 or 1

Other required commands — To use digital horizontal sync, it must be gated on with the HSPG command and digital separate H and V sync must be selected with the SSST command. The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HSPP 0  // Set active low H sync in buffer
HSPG 1  // Enable H sync output in buffer
SSST 1  // Select H&V sync type in buffer
FMTU    // Update hardware to current buffer contents
```


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HSPW

Horizontal Sync Pulse Width

Class — Format parameter setting - Synchronization

Description — Establishes the width of the horizontal sync pulse. The HSPW? query returns the current setting of HSPW.

Command syntax — HSPW *pixels*

pixels

min = 1

max = HTOT - HRES - HSPD

Query syntax — HSPW?

Query response — *pixels*

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HSPW 32  // Set pulse width to 32 pixels in buffer
FMTU     // Update hardware to current buffer contents
```


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HSRS

Horizontal Sync Rate Shift

Class
System parameter settings

801GC, 801GC-ISA, 801GF, 801GF-ISA and 801GX only

Description
Temporarily shifts the horizontal sync frequency of the generator. The first parameter controls the amount of shift (in Hz) and the second parameter controls the approximate length of time (in seconds) that the frequency is shifted, before returning to nominal. Both parameters can be entered as floating point numbers.

Command syntax
HSRS *shift_factor shift_period*

shift_factor
should not exceed ±10% of normal horizontal rate to ensure stable operation of the generator

shift_period
non-negative

Example

```
HSRS -100 2.5  // Shifts the horizontal rate of the currently running
               // format down by 100 Hz for about 2.5 sec.
```


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HSSC

Horizontal Sync Skew Calibration

Class — System Level Parameter

Description — Skews the horizontal pulse delay by the given number of pixels on all formats loaded after issuing the command. The skew is added to the HSPD value of the format that is loaded. The HSSC? query returns the current HSSC setting. Used for correcting HSPD errors on the 801GC, 801GC-ISA and 801GX generators.

Command syntax — HSSC *skew*

skew

min=-10 (integer)

max=+10 (integer)

Query syntax — HSSC?

Query response — *skew*

Example — `HSSC 2`

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HTOT

Horizontal TOTal pixels per line

Class — Format parameter setting - Video resolution

Description — Establishes the total number of pixels per horizontal line. The HTOT? query returns the current setting of HTOT.

The pixel rate is equal to HRAT multiplied by HTOT.

Note: *The current version of the firmware does not allow you to directly enter a specific pixel rate when setting up a format. If your test specifications call for a specific pixel or dot clock rate, enter suitable values for HRAT and HTOT to give you the desired pixel rate.*

Command syntax — HTOT *pixels*

pixels

min:

801GP = 2

801GC, GF, GX = 144

801GC-ISA, GF-ISA = 144

max:

801GP = 2048

801GC, GX = 4096

801GC-ISA = 4096

801GF, 801GF-ISA = 65,536

Query syntax — HTOT?

Query response — *pixels*

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HTOT 800  // Set total to 800
FMTU      // Update hardware to current buffer contents
```


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HVPD?

Horizontal Vertical Sync Pulse Delay

Class	Format Parameter Setting - Synchronization
Description	Returns the pixel delay between the horizontal and vertical sync pulses.
Query syntax	HVPD?
Query response	number of pixels
Example	`HVPD? // read pixel delay between HSYNC and VSYNC pulses` `1 // one pixel delay`
Related commands	None

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HVSA

Horizontal Vertical Sync Adjustment

Class
Format parameter setting - Synchronization

Description
Lengthens the serration period a given number of pixels from the format's nominal default value as required by certain military STANAG video formats. The HVSA? query returns the current setting of HVSA.

Command syntax
HVSA *pixels*

pixels
integer, 0 and less than HSPW

Query syntax
HVSA?

Query response
pixels

Other required commands
The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
HVSA 30;
ALLU
```


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I2CR?

I2C port Read

Class
EDID and DDC control

Description
Automatically reads data using a specified I2C protocol. This command reads data from the DDC port (if equipped), EDID, enhanced DDC (E-DDC) data, and VESA DDC/CI (DDC2Bi) data using the I^2C bus. All numeric parameters are given in ASCII HEX.

> ***Note:*** *EDID-compatible receivers use EPROMs with single-byte or double-byte addresses. The I2CR? query uses different parameters depending on the EPROM type. To determine which EPROM type is used, try both syntaxes until you can read data from the EPROM.*

Query syntax (EPROM with single-byte addresses)
I2CR? eprom *i2c_address offset #_of_bytes*

Query syntax (EPROM with double-byte addresses)
I2CR? eprom1 *i2c_address offset #_of_bytes*

Query syntax (DDC/CI protocol)
I2CR? ddcci *dst_address #_of_bytes*

Query syntax (E-DDC protocol)
I2CR? e_ddc *ddc_pointer_addr segment# i2c_address offset #_of_bytes*

i2c_address (hex)
i^2c bus address (A0, A1,...)

offset (hex)
address offset (in bytes)

#_of_bytes (hex)
number of bytes

dst_address (hex)
destination address

ddc_pointer_addr (hex)
segment pointer address

segment# (hex)
segment pointer number

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Example 1 This example reads a four page E-EDID, using the I2C e_ddc protocol, one page at a time.

```
R:\>i2cr? e_ddc 60 0 a0 0 80
00FFFFFFFFFFFF004489B200050000000D0C010380502D780A0DC9A05747982712484C200
000010101010101010101010101010101011D8018711C1620582C2500C48E2100009E8C
0AD08A20E02D10103E9600138E21000018000000FC0048444D492054560A2020202020000
000FD003B3D0F2E08000A2020202020200306

R:\>i2cr? e_ddc 60 0 a0 80 80
F002020000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000C

R:\>i2cr? e_ddc 60 1 a0 0 80
02031CF14985040802010614121623090707830100006503OC001000011D007251D01E206
E285500C48E2100001ED60980A020E02D1010602200128E210000188C0AD090204031200C
405500C48E21000018011D80D0721C1620102C2580C48E2100009E8C0AA01451F01600267
C4300138E2100009800000000000000000A4

R:\>i2cr? e_ddc 60 1 a0 80 80
020308F1431113158C0AD090204031200C405500138E21000018011D00BC52D01E20B8285
540C48E2100001E8C0AA02051201810187E2300C48E2100009800000000000000000000000
000000000000000000000000000000000000000000000000000000000000000000000000000
00000000000000000000000000000000071
```

Example 2 This command returns 128 bytes of EDID from the connected device.

```
i2cr? e_ddc 60 0 a0 0 80
```

Related commands EDID?, I2CW

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I2CW

I2C port Write

Class
EDID and DDC control

Description
Writes raw binary data from the DDC port (if equipped), EDID, and VESA DDC/CI (DDC2Bi) data using the I^2C bus.

Note: *EDID-compatible receivers use EPROMs with single-byte or double-byte addresses. The I2CW command uses different parameters depending on the EPROM type.*

Command syntax (EPROM with single-byte addresses)
I2CW eprom *i2c_address offset #_of_bytes data*

Command syntax (EPROM with double-byte addresses)
I2CW eprom1 *i2c_address offset #_of_bytes data*

Command syntax (DDC/CI protocol)
I2CW ddcci *dst_address src_address length [command+data+checksum]*

i2c_address (hex)
i^2c bus address (A0, A1,...)

offset (hex)
address offset (in bytes)

#_of_bytes (hex)
number of bytes

data (hex)
data

command (hex)
command

checksum (hex)
checksum

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Example 1 This command writes the first 8 bytes of EDID to the EPROM.

Note: *Always confirm that you can successfully read an address (using the I2CR? query) before writing to that address.*

```
i2cw eprom a0 0 8 00FFFFFFFFFFFF00
```

Example 2 This command reads the EDID from a specified address.

```
i2cr? eprom a0 0 80
```

Example 3 This command writes DDC2Bi data.

```
i2cw ddcci 6E 51 81 B10F
```

Example 4 This commands reads the DDC2Bi data.

```
i2cr? ddcci 6F 5
```

Related commands EDID?, I2CR?

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IDET

Initialization DETect

Class — System Parameter

Description — Stores the integer flag value in non-volatile memory. The value is not changed except by 1) another IDET command, 2) re-initializing the unit with an INIT command, or 3) the system firmware because the power-up self test found corrupted data in battery backed system memory. In cases 2 and 3, the IDET value will revert to 0. The IDET? query returns the current IDET value. The IDET command and query are used by automated test systems to determine if a particular unit has been replaced or reinitialized since it had its IDET value set to unique number by that system.

Command syntax — IDET *integer flagNeed help with this syntax and parameter formatting.*

-2,147,483,647 ??integer flag?? +2,147,483,647

Query syntax — IDET?

Query response — *flag*

Example

```
IDET 19980616  // Set IDET to a non-zero value
```


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IFGU

InfoFrame Generator Use

Class — InfoFrame Generator (IFG) parameter

Description — Updates hardware with current InfoFrame contents.

Command syntax — IFGU

Example

```
IFTG 14
IFGU
```

Related commands — IFTG, IFTR, XGIF, XAVI, XSPD, XAUD, XMPG

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IFTG

InfoFrame Type Gate

Class — InfoFrame Generator (IFG) parameter

Description — Gates the InfoFrames by type. The mask value is a value ORed with the current setting.

Note: *For more information about the InfoFrame structure, see the EIA Standard EIA/CEA-861-B (Section 6).*

Command syntax — IFTG *mask*

mask

A bit mask based on these InfoFrame type values.

Type	Value
GIF	1
AVI	2
SPD	4
AUD	8
MPG	16

Example — This example enables AUD (8), SPD (4), and AVI (2) InfoFrames (but not MPG and GIF InfoFrames). The MPG and GIF InfoFrames are gated off, and loaded with zeros.

```
IFTG 14
IFGU
```

Related commands — IFGU, IFTR

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IFTR

InfoFrame Type Repeat Mask

Class InfoFrame Generator (IFG) parameter

Description Specifies if an InfoFrame type is to be sent once (after the IFGU command is executed), or sent in every vertical blanking period (frame).

Note: *For more information about the InfoFrame structure, see the EIA Standard EIA/CEA-861-B (Section 6).*

Command syntax IFTR *mask*

mask

A bit mask based on these InfoFrame type values.

Type	Value
GIF	1
AVI	2
SPD	4
AUD	8
MPG	16

Example This example specifies that AUD (8) and AVI (2) InfoFrames should be repeated with every frame, and other InfoFrame types should be sent once.

```
IFTR 10
IFGU
```

Related commands IFTG, IFGU

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IMGA

IMaGe save As

Class — Image memory management

Description — Saves the current contents of the image edit buffer using the given name.

Command syntax — IMGA *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Example

```
IMGA MY_IMG  // Save with the name "MY_IMG"
```


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IMGB

IMaGe editing Begin

Class — Image editor control

Description — Marks the beginning of an image editing session.

Command syntax — IMGB

Other required commands — Use either an IMGL command to load an existing image or an IMGN command to create a new image. Use IMGE when ending the editing session.

Example

```
IMGN  // Initialize image edit buffer
IMGB  // Start image editing session

      // One or more image editing
      // commands ...

IMGE  // End image editing session
```


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IMGE

IMaGe editing End

Class — Image editor control

Description — Marks the end of an image editing session.

Command syntax — IMGE

Other required commands — Use IMGB when starting the editing session. Use IMGA or IMGS to save changes.

Example

```
IMGB            // Start image editing session

                // One or more image editing commands ...

IMGA MYIMG_02   // Save edited image as "MYIMG_02"
IMGE            // End image editing session
```


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IMGK

IMaGe Kill

Class — Image memory management

Description — Deletes an image by name. The query returns a 1 if the named image can be deleted. If the image is read-only or nonexistent, the query returns a 0.

Command syntax — IMGK *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — IMGK? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response — 0 or 1

Example

```
IMGK MY_IMG  // Delete dir called "MY_IMG"
```


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IMGL

IMaGe Load

Class
Image memory management

Description
Assigns an image to the current step of a sequence while between a set of SEQB and SEQE commands. The IMGL command is context sensitive. The IMGL? query returns the name of the image currently assigned to the step.

Outside of the sequence editor, the IMGL command copies the image having a name equal to name from image memory into the image edit buffer. The query returns a one (1) if the named image can be loaded, otherwise a zero (0) is returned.

Command syntax
IMGL *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax
IMGL? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response
0 or 1

Other required commands
An ALLU or IMGU command must be executed after the IMGL command to cause the image in the edit to draw on the unit under test.

Example

```
IMGL MY_IMG  // Load "MY_IMG" dir in edit buffer
IMGU         // Draw contents of buffer
```


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IMGN

IMaGe New

Class — Image editor control

Description — Initializes the image edit buffer. The name *name* is assigned as the image's name. The query will return the name that has been assigned as the image's name.

Command syntax — IMGN *name*

name
optional valid MS-DOS filename (8 characters minus any extension)

Query syntax — IMGN?

Query response — name

Example

```
IMGN          // Init edit buffer without assigning a new name
```

or

```
IMGN MY_IMG  // Init edit buffer with name of "MY_IMG"
```


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IMGP

IMaGe Path

Class — Image memory management

Description — Sets the current image path name to a given directory. The query will return the current image path name.

Command syntax — IMGP *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — IMGP? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response — *name*

Example

```
IMGP FINAL  // Sets image pathname to a directory called "FINAL".
```


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IMGQ?

IMaGe Query pointer

Class — Image memory management

Description — Returns number image names from the list of all the images stored in image memory beginning at index. The images are kept in alphanumeric order.

Query syntax — IMGQ? *index number*

index
positive integer number

number
positive integer number

Query response — List of specified image names

Example

```
IMGQ? 1 5     // List the first five images in memory
```

or

```
IMGQ? 1 9999  // List all images in memory
```


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IMGR

IMaGe Read image from image memory location

Class
Image memory management

Description
Copies the image residing in the image memory with location *location* into the image buffer. The IMGR command does not cause the selected image to be drawn. See the IMGU command for actually drawing the image. Using the IMGL command to load images by name is the preferred method of selecting images.

Command syntax
IMGR *location*

location
-1 through -26 (EPROM)

Other required commands
The IMGU command draws the image. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
IMGR 1  // Select first custom image in memory
IMGU    // Draw the image
```


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IMGS

IMaGe Save

Class	Image memory management
Description	Saves the current contents of the generator's custom image edit buffer back to the memory location from which it was originally read.
Command syntax	IMGS

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IMGU

IMaGe Use

Class — Image memory management

Description — Draws an image based on the current contents of the image. The IMGU? query returns the image memory location *location* from which the current contents of the image were read. See the IMGR command for setting the contents of the image.

Command syntax — IMGU

Query syntax — IMGU?

Query response — *location*

location
-1 through -26 (EPROM)

Example

```
IMGL BriteBox  // Select the BriteBox test image
IMGU           // Draw the selected test image
```


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INIT

INITialize to factory default settings

Class — Direct processor control

Description — Restores the contents of all of the generator's RAM storage locations to factory-default conditions. The generator then goes through a complete self-test and self-calibration procedure.

Important: *The INIT command permanently and irreversibly removes all user-created formats, custom images, test sequences, and directories from memory.*

Command syntax — INIT

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ISTP?

Image STep

Class	Image editor control
Description	Allows the contents of user created custom images to be copied out of a generator. The contents of the firmware-based, built-in test images cannot be read out since they are not created as a set of primitives.
Query syntax	ISTP? returns the number of steps in the custom image in the edit buffer. or ISTP? *step_number* returns the contents of the given step in the custom image in the edit buffer as a space delimited text string.
Other required commands	A custom image must have been loaded with the IMGL command and editing must have been started with the IMGB command

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ISUB

Image Step Button

Class
System parameter settings

Description
Determines if the Image Step key is on or off to allow activation of alternate versions of test images that have alternate versions.

The ISUB? query returns the current setting of ISUB.

Command syntax
ISUB *mode*

mode

0 = OFF

1 = ON

Query syntax
ISUB?

Query response
0 or 1

Example

```
IMGL SlideBox    // Load image
ISUB 1           // Enable alternate versions
IVER 1           // Load version 1
IMGU             // Update display
```


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IVER

Image VERsion

Class
System parameter settings

Description
Determines which version of an image is used for the current step of a sequence while between a set of SEQB and SEQE commands. The IVER command is context sensitive. The IVER? query returns the version currently assigned to the step.

Outside of the sequence editor, the IVER command selects which version of the current image is drawn when either an ALLU or IMGU command is executed. The IVER? query returns the current setting of IVER.

Command syntax
IVER *mode*

mode

0 = Normal

1 = Invert or display alternate version

Query syntax
IVER?

Query response
0 or 1

Other required commands
The IMGU command redraws an image using the new setting. The ALLU command updates hardware and redraws the test image with the new setting.

Example

```
IMGL Text_9  // Select image with white text on black
IVER 1       // Select inverted with black on white
IMGU         // Draw the image as selected
```


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JDVI

Justify pixel clock rate for DVI formats

Class
Format editor control

Description
Scales the horizontal timing parameters of the format currently in the edit buffer. The parameters are scaled to produce the given pixel rate while keeping the horizontal scan rate as close as possible to its original value. The following parameters are scaled: horizontal total pixels, horizontal active pixels, horizontal sync delay in pixels, and horizontal sync pulse width in pixels. The parameters are scaled so that their periods, in microseconds, are as close as possible to their original values.

Command syntax
JDVI *pixel_rate*

pixel_rate
floating point number equal to the desired pixel in MHz

Query syntax
JDVI?

Query response
pixel_rate

Other required commands
The ALLU command updates hardware to the new settings and redraws the test image.

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JLDI

Justify pixel clock rate for LDI formats

Class	Format editor control
Description	Scales the horizontal timing parameters of the format currently in the edit buffer. (For the 801LD used in digital mode, the default is set at 224 MHz.) The parameters are scaled to produce the given pixel rate while keeping the horizontal scan rate as close as possible to its original value. The following parameters are scaled: horizontal total pixels, horizontal active pixels, horizontal sync delay in pixels, and horizontal sync pulse width in pixels. The parameters are scaled so that their periods, in microseconds, are as close as possible to their original values.
Command syntax	JLDI *pixel_rate* *pixel_rate* floating point number equal to the desired pixel in MHz
Query syntax	JLDI?
Query response	*pixel_rate*
Other required commands	The ALLU command updates hardware to the new settings and redraws the test image.

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JRAT

Justify pixel clock RATe

Class — Format editor control

Description — Scales the horizontal timing parameters of the format currently in the edit buffer. The parameters are scaled to produce the given pixel rate while keeping the horizontal scan rate as close as possible to its original value. The following parameters are scaled: horizontal total pixels, horizontal active pixels, horizontal sync delay in pixels, and horizontal sync pulse width in pixels. The parameters are scaled so that their periods, in microseconds, are as close as possible to their original values.

Command syntax — JRAT *pixel_rate*

pixel_rate
floating point number equal to the desired pixel in MHz

Other required commands — The ALLU command updates hardware to the new settings and redraws the test image.

Example

```
JRAT 202.000E6 // Adjust timing to a 202.000 MHz clock
FMTU           // Update hardware to current buffer contents
```


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KEYY

KEY toggle

Class — System parameter settings

Description — Toggles the status of the following items: image version of the currently displayed image, red, green and blue video gating, ACS, DCS, and DSS sync gating, and outputs gating. The order of the keys matches the order of the keys found on the front panel of the generator. The current status of the keys can be checked using the LEDS?? query.

Command syntax — KEYY *key*

key

1 = image (step) version

2 = red gating

3 = green gating

4 = blue gating

5 = ACS gating

6 = DCS gating

7 = DSS gating

8 = outputs gating

Example

```
KEYY 8  // Toggle current status of output gates
```


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KNOB

rotate KNOB

Class
System parameter settings

Description
Mimics turning the Format or Image knob on the generator.

When a sequence is running, the Format knob loads sequences from the directory selected by the SEQP command. Clockwise rotation increases the index pointer for the directory. The Image knob is used to go back and forth through the sequence steps. Clockwise rotation selects higher step numbers.

Command syntax
KNOB *number clicks*

number

1 = upper Format knob

2 = lower Image knob

clicks

An integer representing the number of knob increments from the current active format or image. A positive integer indicates a clockwise move to a higher index number. A negative integer indicates a counterclockwise move to a lower index number.

Example

```
KNOB 2 1  // Move Image knob 1 click CW
KNOB 1 -10 // Move the Format knob 10 clicks CCW
```


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LCDS?

LCD Status

Class System parameter settings

Description Returns text displayed on LCD of the generator.

Query syntax LCDS?

Example
```
LCDS?  // Return text similar to text below
       // H32 15=VGA_m3 crlf
       // V60 51=SMPTE133
```


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LEDS?

LED Status

Class — System parameter settings

Description — Returns the current status of the generator's signal generating hardware as a single decimal number. The number corresponds to the status of the lighted key on the generator in normal operation. The easiest way to interpret the number is to first convert it to an 8-digit binary number. A 1 in a given position, from MSB to LSB, corresponds to the following hardware settings:

Master output control gated ON (MSB)

Digital Separate (HS&VS) Sync selected

Digital Composite Sync selected

Analog Composite Sync selected

Blue video enabled

Green video enabled

Red video enabled

Alternate image version selected (LSB)

Query syntax — LEDS?

Query response — decimal number from 0 to 255

Example

```
LEDS?
// Returns the following number when the outputs are gated ON, separate
// HS & VS is selected, the red, green and blue video channels are
// enabled and the primary version of an image is selected.

206  // Binary equivalent = 11001110
```


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LIMI

draw video LIMIts markers

Class
Custom image primitive

Description
Places nine markers that define the active video area. An L-shaped marker is placed at each corner. T-shaped markers are centered along each edge of video, and a small cross is placed at the center of video. The primitive uses a single parameter: color.

Command syntax
LIMI *color*

color
available colors

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
LIMI white  // Place white markers that define active video area
ALLU        // Update hardware to current buffer contents
```


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LINE

draw a LINE

Class
Custom image primitive

Description
Draws a line between any two points. The line is 1 pixel thick. The primitive uses five parameters: the color and x,y coordinates for both endpoints.

Command syntax
LINE *color x_start y_start x_end y_end*

color
available colors

x_start, y_start, x_ end, y_end
positive integer number

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
LINE yellow 20 5 320 240
      // Draw yellow line from X=20, Y=5 to X=320, Y=240

ALLU  // Update hardware to current buffer contents
```


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LLOS

Local Lock Out State

Class — System Control

Description — Enables the use of the front panel keys and knobs (local operation) on the generator that may have been previously disabled with the GTLS command. The LLOS? query returns the current local lockout state.

Command syntax — LLOS

Query syntax — LLOS?

Query response — *status*

0 = local lockout disabled

1 = local lockout enabled

Example

```
LLOS  // Disable the use of front panel controls
```


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LMAX

Lut MAXimum level (Analog)

Class — Lookup Table memory management

Description — Establishes the maximum integer lookup table level representing full white.

Command syntax — LMAX *level*

level integer

min = 0

max = 65,535

Query syntax — LMAX?

Example — `LMAX 1024`

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LMAX

Digital Video Maximum quantizing Level

Class — Format parameter setting - Digital video signal

Description — Sets the maximum quantizing level of the component video signal for white. The default varies depending on the number of bits per color component. Some applications may require that the maximum level be set lower than the maximum permissible. The query reads the current setting for the maximum level.

Command syntax — LMAX *video_level*

video_level
unsigned integer from 59 to 63 when NBPC is 6 gamuts; 235 to 255 when NBPC is 8 gamuts; 940 to 1023 when NBPC is 10 gamuts; 3760 to 4095 when NBPC is 12 gamuts.

Query syntax — LMAX?

Example — LMAX 254 // To set the maximum digital quantizing level to 254

Related commands — LMIN, NBPC, DVQM

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LMIN

Digital Video Minimum quantizing Level

Class — Format parameter setting - Digital video signal

Description — Sets the minimum quantizing level of the component video signal for black. The default is 0 for black; however, some applications may require that the minimum level be set higher. The query reads the current setting for the minimum level.

Command syntax — LMIN *video_level*

video_level

unsigned integer from 0 to 4 when NBPC is 6 gamuts; 0 to 16 when NBPC is 8 gamuts; 0 to 64 when NBPC is 10 gamuts; 0 to 256 when NBPC is 12 gamuts

Query syntax — LMIN?

Example — LMIN 16 // To set the minimum digital quantizing level to 16

Related commands — LMAX, NBPC, DVQM

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LSPG

Line Sync Pulse Gate

Class — Format parameter settings

Description — Enables and disables the digital horizontal sync output. The LSPG? query returns the current LSPG mode.

Command syntax — LSPG *mode*

mode integer

0 = OFF

1 = ON

Query syntax — LSPG?

Query response — 0 or 1

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
LSPG 1      // Enable Line Sync
FMTU        // Update hardware to new settings
```


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LSPP

Line Sync Pulse Polarity

Class — Format parameter setting - Synchronization

Description — Establishes the logic sense of the digital line sync output. Setting polarity to 1 causes the leading edge of line sync to be a low-to-high transition. Setting polarity to 0 causes the leading edge of line sync to be a high-to-low transition. The LSPP? query returns the current polarity of LSPP.

Command syntax — LSPP *polarity*

polarity

0 = active-low (negative going pulse)

1 = active-high (positive going pulse)

Query syntax — FSPP?

Query response — 0 or 1

Other required commands — In order to get a pulse, line sync must first be enabled with the LSPG command. The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Example

```
LSPG 1      // Enable Line Sync
LSPP 1      // Set for positive going pulse
LSPW 20     // Make the pulse 20 pixels wide
LSPG 300    // Pulse to occur 300 lines after
            // the last line of active video
FMTU        // Update hardware to new settings
```


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LUTA

LUT save As

Class — Lookup Table memory management

Description — Saves the current contents of the lookup table edit buffer using the given name.

Command syntax — LUTA *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Example

```
LUTA MY_LUT  // Save with the name "MY_LUT"
```


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LUTB

LUT editing Begin

Class — Lookup Table memory management

Description — Marks the beginning of a lookup table editing session.

Command syntax — LUTB

Other required commands — Use either an LUTL command to load an existing lookup table or an LUTN command to create a new lookup table. Use LUTE when ending the editing session.

Example

```
LUTN  // Initialize lookup table edit buffer
LUTB  // Start lookup table editing session
      // One or more lookup table editing commands
      // ...
LUTE  // End lookup table editing session
```


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LUTE

LUT editing End

Class — Lookup table editor control

Description — Marks the end of a lookup table editing session.

Command syntax — LUTE

Other required commands — Use LUTB when starting the editing session. Use LUTA or LUTS to save changes.

Example

```
LUTB  // Start lookup table editing session
      // One or more lookup table editing commands
      // ...
LUTA My_LUT1  // Save edited lookup table as My_LUT1
LUTE  // End lookup table editing session
```


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LUTK

LUT Kill

Class — Lookup table memory management

Description — Erases the named lookup table from memory. The LUTK? query checks to see if the named lookup table can be erased. The RAM location number is returned if it can be erased. Otherwise, a zero is returned.

Command syntax — LUTK *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — LUTK? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response — 0 or location

Example

```
LUTK my_LUT1  // Erase lookup table called my_LUT1 LUTL
```


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LUTL

LUT Load

Class
Lookup table memory management

Description
Reads the lookup table having a name equal to name *name* from lookup table memory (or EPROM) into the lookup table. LUTL does not re-configure the signal generating hardware. This feature allows you to work on the contents of any lookup table memory location, while continuing to output a signal based on a previously-used lookup table (see LUTU command). The LUTL? query returns the location *location* in which a lookup table having a name equal to *name* is found. If multiple lookup tables exist having name *name*, then the lowest numbered location containing a lookup table with a matching name *name* is returned. The lookup table memory (RAM) is always searched first. If a lookup table with name *name* cannot be found anywhere in the lookup table memory, then the industry-standard lookup tables located in EPROM (negative locations) are searched next. LUTL? returns 0 if a lookup table with a name equal to name *name* cannot be found in either lookup table space.

Command syntax
LUTL *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax
LUTL? *name*

Query response
location (returns 0 if not found)

Other required commands
The LUTU command updates the hardware to the new settings.

Example
```
LUTL my_lut  // Load lookup table called my_lut
```


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LUTN

LUT New

Class — Lookup table editor control

Description — Initializes the lookup table editing buffer and optionally sets the filename.

Command syntax — LUTN *name*

name
(optional) valid MS-DOS filename (8 characters minus any extension)

Other required commands — The LUTB command must be used to enable editing of the initialized buffer.

Example

```
LUTN my_lut2  // Create new edit buffer for my_lut2
LUTB          // Begin editing
```


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LUTQ?

LUT Query pointer

Class
Lookup table memory management

Description
Returns number lookup table names from the list of all the lookup tables stored in lookup table memory beginning at *index*. The lookup tables are kept in alphanumeric order.

Query syntax
LUTQ? *index number*

index
positive integer number

number
positive integer number

Query response
List of specified lookup table names.

Examples:

```
LUTQ? 1 5  // List the first five lookup tables in memory
```

or

```
LUTQ? 1 9999  // List all lookup tables in memory
```


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LUTS

LUT Save

Class — Lookup table memory management

Description — Saves the current lookup table edit buffer contents into lookup table memory using the current name of the lookup table in the edit buffer.

Command syntax — LUTS

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LUTU

LUT Use

Class — Lookup table memory management

Description — Loads the lookup table hardware in accordance with the buffer contents.

The LUTU? query returns either a lookup table memory location *location* or 0. If the lookup table currently in the hardware matches that originally loaded (using the LUTL command) from a lookup table memory location, then the matching lookup table memory location *location* is returned. Otherwise, if the hardware contents have changed since either an LUTR or LUTL command has been issued, then LUTU? query returns 0.

Command syntax — LUTU

Query syntax — LUTU?

Query response — *location* or 0

Example

```
LUTU  // Update hardware to current buffer contents
```


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MAPA

bitMAP save As

Class Bitmap memory management

Description Saves the current contents of the bitmap edit buffer using the given name.

Command syntax MAPA *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Example
```
MAPA MY_MAP  // Save with the name "MY_MAP"
```


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MAPB

bitMAP editing Begin

Class — Bitmap editor control

Description — Marks the beginning of a bitmap editing session.

Command syntax — MAPB

Other required commands — Use either an MAPL command to load an existing image or an MAPN command to create a new bitmap. Use MAPE when ending the editing session.

Example

```
MAPN  // Initialize bitmap edit buffer
MAPB  // Start bitmap editing session

      // One or more bitmap editing commands ...

MAPE  // End bitmap editing session
```


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MAPE

bitMAP editing End

Class — Bitmap editor control

Description — Marks the end of a bitmap editing session.

Command syntax — MAPE

Other required commands — Use MAPB when starting the editing session. Use MAPA or MAPS to save changes.

Example

```
MAPB           // Start bitmap editing session

               // One or more bitmap editing commands ...

MAPA My_map1   // Save edited bitmap as My_map1
MAPE           // End bitmap editing session
```


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MAPK

bitMAP Kill from memory by name

Class
Bitmap memory management

Description
Erases the named bitmap from memory. The MAPK? query checks to see if the named bitmap can be erased. The RAM location number is returned if it can be erased; otherwise, a 0 is returned.

Command syntax
MAPK *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax
MAPK? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response
0 or *location*

Example
```
MAPK my_map1  // Erase bitmap called my_map1
```


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MAPL

bitMAP Load from memory by name

Class — Bitmap memory management

Description — Reads the bitmap having a name equal to *name* from bitmap memory into the bitmap buffer. MAPL does not change what is being displayed from the video memory. The MAPL? query returns the location *location* in which a bitmap having a name equal to *name* is found. If multiple bitmaps exist having name *name*, then the lowest numbered location containing a bitmap with a matching name *name* is returned. MAPL? returns 0 if a bitmap with a name equal to *name* cannot be found.

Command syntax — MAPL *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — MAPL? *name*

Query response — *location* (returns 0 if not found)

Example

```
MAPL SHAPE01  // Load bitmap called SHAPE01 into the buffer
```


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MAPN

bitMAP New

Class Bitmap editor control

Description Initializes the bitmap editing buffer.

Command syntax MAPN *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Example
```
MAPN       // Intialize bit-map buffer
```
or
```
MAPN Cool  // Initialize format buffer and name the format "Cool".
```


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MAPQ?

bitMAP Query pointer

Class — Bitmap memory management

Description — Returns bitmap names from the list of all the bitmaps stored in bitmap memory beginning at *index*. The bitmaps are kept in alphanumeric order. The generator maintains internal variables for the current *index* and *number* values. The value of *index* is automatically incremented by *number* after the query is executed. Sending the query with just an *index* parameter returns the same number of names as the last time, starting at the given index. Sending the query with no parameters returns the next set of names.

Query syntax — MAPQ? *index number*

index
positive integer number

number
positive integer number

Query response — List of specified bitmap names.

Example

```
MAPQ? 1 9999  // List all bitmaps in memory
```

or

```
MAPQ? 1 10    // List the first ten bitmaps in memory
MAPQ? 21      // List the 21st through the 30th MAPes in memory
MAPQ?         // List the 31st through the 40th MAPes in memory
```


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MAPS

bitMAP Save

Class Bitmap memory management

Description Saves the current bitmap edit buffer contents into bitmap memory using the current name of the bitmap in the edit buffer.

Command syntax MAPS

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MEMC

MEMory Compact

Class MEM

Description Consolidates free memory into contiguous blocks.

Command syntax MEMC?Is this a command or query. If query, what is the response?

Example
```
MEMC    // Compact the system memory
```

Related commands MEMF?, MEML?

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MEMF?

MEMory Free

Class MEM

Description Returns the number of free blocks in managed memory.

Query syntax MEMF?

Example
```
MEML?   // to determine the amount of free memory block
818088  // lists the number of contiguous free memory blocks
```

Related commands MEMC, MEML?

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MEML?

MEMory Largest free

Class MEM

Description Returns the largest free contiguous block in managed memory.

Query syntax MEML?

Example
```
MEML?   // to determine the largest contiguous block of free memory
816568  // lists the amount of contiguous free memory
```

Related commands MEMC, MEMF?

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MEMT

MEMory Test

Class MEM

Description Runs a memory manager test to detect corruption or inconsistencies. The MEMT? query returns the results of the most recent run of the memory manager test command.

Command syntax MEMT

Query syntax MEMT?

Query response 0 or 1

0 = no memory corruptions or inconsistencies were discovered

1 = a memory corruption or inconsistency was found

Example
```
MEMT   // to run the memory manager test
MEML?  // to view the results of the memory manager test
```

Related commands MEMC, MEMF?

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MMAP

Move a rectangular bitMAP area

Class Video Frame Buffer manipulation

Description Copies a rectangular area of pixels from one location of the video frame buffer to another. The size of the area, in pixels, is defined by the *width* and *height* parameters. The top left corner of the source location is specified by *xs*, *ys* pixel coordinates. The top left corner of the destination location is specified by the *xd*, *yd* pixel coordinates.

Command syntax MMAP *width height xs ys xd yd*

width, height
size of the area, in pixels

xs, ys
top left corner of the source location

xd, yd
top left corner of the destination location

Query syntax MMAP?

Example
```
MMAP 40 30 0 0 50 50  // Copies a 40 pixel wide by 30 pixel high area
                      // in the top left corner of active video to an
                      // area 50 pixel below and to the right of the top
                      // left corner.
```


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MODE

communications MODE

Class — System parameter settings

Description — Sets the serial port communications parameters of a stand-alone model generator. The changes take effect as soon as the command is entered. The factory default settings are 2400 baud, no parity, 8 data bits, no stop bits, no handshake, and no protocol.

Command syntax — MODE *baud parity data stop handshake protocol*

baud rate
300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200 bits/sec

parity
N = None, E = Even or O = Odd

data
number of data bits: 7 or 8

stop
number of stop bits: 1 or 2

handshake
N = None

H = Hardware (CTS/RTS)

protocol
N = None

Y=Y-Modem

Example

```
MODE 9600 N 8 1 H N  // Set a stand alone generator to
                     // communicate at 9600 Baud, No parity, 8 data bits,
                     // 1 stop bit, RTS//CTS handshaking and No protocol
```

or

```
MODE 2400  // Change only the baud rate
```


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MSIZ

light Meter SIZe

Class
System parameter settings

Description
Establishes the physical size of the light meter boxes displayed in the BriteBox test image. The unit of measure used is based on the current setting of the system level USIZ command. It also affects the size of the cursor boxes in the Persist image. Changing the size will not change the currently displayed image. The MSIZ? query returns the current settings of MSIZ based on the current setting of the system level USIZ command.

Command syntax
MSIZ *width height*

or

MSIZ *common_size*

size
positive floating point number

common_size
square box

Query syntax
MSIZ?

Query response
width, *height*

Other required commands
The correct unit of measure should be selected with the USIZ command prior to setting the size.

Example

```
USIZ 1          // Select inches for units
MSIZ 2.0        // Set size to 2.0 inches
IMGL BriteBox   // Select BriteBox image
IMGU            // Draw selected image using new size
```


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MUTE

Audio/Video Mute

Class — Sonic data generator

Description — Enables and disables the HDMI Audio/Video Mute (AVMUTE) feature. When enabled, audio and video are muted by the generator.

Command syntax — MUTE *flag*

flag

0 = disable (AVMUTE_clear_flag sent repeatedly)

1 = enable (AVMUTE_set_flag sent repeatedly)

Query syntax — MUTE?

Query response — 0 or 1

Related commands

Example — To enable AVMUTE:

```
MUTE 1
MUTE?
```

Use the MUTE? to continuously check until the AVMUTE state is changed (may not take place right away).

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NAMF?

NAMe Find

Class — Directory editor control

Description — Returns the index number of the entry with name *name* in the directory edit buffer. The first name in the buffer has an index value of 1. If name is not found, a value of 0 is returned.

Query syntax — NAMF? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response — *index*

Example

```
NAMF? VGA_m4  // Return position of VGA_m4 in directory
```


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NAMI

NAMe Insert

Class — Directory editor control

Description — Moves all the names with index values equal to or greater than *index* to the next higher index value in the directory edit buffer, and then inserts the name *name* in the directory edit buffer at position *index*. A negative number or a 0 used for *index* will put *name* at index position 1. Using a number for *index* beyond the last name in the buffer will add *name* to the index position just beyond the last name. The command does not check if a file called *name* is stored in the generator.

Command syntax — NAMI *index name*

name
a valid MS-DOS filename (8 characters minus any extension)

Example 1 — This example inserts the DMT0660A format on the knob list at location 1:

```
DIRL FMT
DIRB
NAMI 1 DMT0660A
DIRE
DIRS
```

Example 2

```
NAMI 5 FOCUS1  // Put FOCUS1 in fifth position
```

Example 3

```
NAMI -6 BARS  // Put BARS at beginning of dir
```

Example 4

```
NAMI 999999 HATCH  // Put HATCH at end of dir
```


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NAMK

NAMe Kill

Class Directory editor control

Description Deletes the given name from the directory edit buffer. All names with index values greater than the index of the deleted name are moved to the next lower index value in the buffer. Nothing happens if name is not found in the buffer.

Command syntax NAMK *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Example
```
NAMK VGA_m4  // Remove VGA_m4 from dir
```


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NAMQ?

NAMe Query

Class
Directory editor control

Description
Returns number names from the list of names in the directory edit buffer beginning at *index*. The generator maintains internal variables for the current *index* and *number* values. The value of *index* is automatically incremented by *number* after the query is executed. Sending the query with just an index parameter, will return the same number of names as the last time, starting at the given index. Sending the query with no parameters will return the next set of names in the directory buffer.

Query syntax
NAMQ? *index number*

index
positive integer number

number
positive integer number

Query response
List of specified entry names from directory edit buffer.

Example 1
```
NAMQ? 1 9999  // List the entire buffer
```

Example 2
```
NAMQ? 1 10   // List the first ten names in the buffer
NAMQ? 21     // List the 21st through the 30th names in the buffer
NAMQ?        // List the 31st through the 40th names in the buffer
```


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NAMY

NAMe Yank

Class Directory editor control

Description Deletes the name at the given index number from the directory edit buffer. All names with index values greater than the index of the deleted name are moved to the next lower index value in the buffer. Nothing happens if index is beyond the index number of last name in the buffer.

Command syntax NAMY *index*

Example
```
NAMY 2  // Remove second item from dir
```


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NBPA

Number Bits Per Audio sample

Class — Format parameter setting - Audio signal

Description — Sets the number of bits per audio sample for an audio signal. This sets the SS parameter of the Audio InfoFrame (as specified in EIA/CEA-861-B, table 20).

Command syntax — NBPA *bits*

bits

0 (let incoming external audio stream determine the number of bits per sample)

16

Example

```
NBPA 16
IFGU
```

Related commands — XAUD (SS parameter), SAMP

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NBPC

Number Bits Per Component

Class — Format parameter setting - Digital video signal

Description — Sets the number of bits per color component (color depth).

Command syntax — NBPC *bits*

bits

6, 8, 10, or 12 depending on output.

Output	NBPC
DVI	8
TV	12
LVDS	6 (18-bit encoding) or 8 (24-bit encoding)
HDMI Digital RGB or YCbCr 4:4:4 output	8
HDMI YCbCr 4:2:2 output	8, 10, or 12.

Example

```
NBPC 10
FMTU
```

Related commands — DVSM, DVQM

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NCPP

Number Clocks Per Pixel

Class — Format parameter setting - Digital video signal

Description — Specifies the number of clocks per pixel (double-clocking factor for whole line). Some industry standard formats (e.g. 480i) have pixel rates that are below the minimum pixel rate restriction (of 25 MHz) required by the TMDS interface. In these cases, a feature known as “double-clocking” is used to raise the TMDS clock rate to an acceptable frequency.

Double-clocking is controlled by the NCPP format parameter. When NCPP is set to 1 (normal single-clocked), each pixel, output by the generator, is paired with one clock pulse. In this case, the pixel rate is equal to the TMDS clock rate. By setting NCPP to 2 (double-clocked), two clocks are send during each pixel period and the TMDS clock rate is raised to 2 times the pixel rate.

Note that double clocking with NCPP and pixel repetition (NPPP) cannot be applied at the same time.

Command syntax — NCPP *factor*

factor
1 or 2

Related commands — NBPA, NPPP

Example —

```
NCPP 2
FMTU
```


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NDAC

Number Digital Audio Channels

Class — Format parameter setting - Audio signal

Description — Sets the number of digital audio channels for an audio signal. This sets the CC parameter of the Audio InfoFrame (as specified in EIA/CEA-861-B, table 20).

Note: *Currently, only two audio channels are supported.*

Command syntax — NDAC *channels*

channels

2

Example

```
NDAC 2
IFGU
```

Related Commands — XAUD (CC parameter)

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NDAS

Number Digital Audio Streams

Class — Format parameter setting - Audio signal

Description — Sets the number of digital audio streams.

Note: *Currently, only one audio stream is supported.*

Command syntax — NDAS *streams*

streams
1 (default)

Example

```
NDAS 1
IFGU
```


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NERR?

Number of ERRors in queue

Class	System memory management
Description	Returns the number of errors waiting to be reported in the error queue.
Query syntax	NERR?
Query response	number of errors

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NLNK

Number of digital LiNKs

Class — Format parameter setting - Digital video signal

Description — Determines the number of links used by the LVDI digital outputs on generators that support LVDI outputs. The NLNK? query returns the current setting of NLNK.

Command syntax — NLNK *links*

links integer

0 = Default, let the generator decide

1 = Single link

2 = Dual link

Query syntax — NLNK?

Query response — *links*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example — `NLNK 2; FMTU`

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NOGA

use NO GAmma correction

Class Custom image primitive

Description Temporarily disables any gamma correction that may be selected in a format. All color intensity levels in all parts of the custom image are output without gamma correction. Gamma correction is disabled only for as long as the image is displayed.

Command syntax NOGA

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NOTU

NOT Until communication is complete

Class	System Level
Description	Temporarily holds-off any ongoing command execution until communication is complete and ALLU is invoked.
Command syntax	NOTU
Query syntax	NOTU?
Query response	0 if not enabled non-zero when enabled
Other required commands	Disabled by ALLU.

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NPPP

Number Pixels Per Pixel

Class — Format parameter setting - Digital video signal

Description — Specifies repetition factor for active portion of line.

Command syntax — NPPP *factor*

factor

0 to disable repetition mode (removes extra left and right repetition bars)

1 to 10 enables pixel repetition mode (inserts extra left and right repetition bars)

Related commands — NCPP

Example

```
NPPP 4; FMTU
```


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NSTP?

Number of STePs in sequence

Class	Sequence editor control
Description	Returns the number of steps in a sequence in the buffer.
Query syntax	NSTP?
Query response	steps

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OERR?

ERRor queue Overflow

Class: System memory management

Description: Checks for overflow in the error queue. Overflow occurs when an attempt is made to add more errors to the queue than it can hold.

Query syntax: OERR?

Query response: overflow status

0 = No Overflow

1 = Overflow

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OFFX

image OFFset X

Class — Image editor control

Description — Sets the horizontal offset used for the large patch in the Regulate test image. It may also control other images. The OFFX? query returns the current OFFX setting.

Command syntax — OFFX *x_offset*

x_offset integer
number of pixels

Query syntax — OFFX?

Query response — X offset

Example — `OFFX 20`

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OFFY

image OFFsetY

Class — Image editor control

Description — Sets the vertical offset used for the large patch in the Regulate test image. It may also control other images. The OFFY? query returns the current OFFY setting.

Command syntax — OFFY *y_offset*

y_offset integer
number of pixels

Query syntax — OFFY?

Query response — Y offset

Example — `OFFY 20`

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OUTG

OUTputs Gate

Class — System parameter settings

Description — Gates all video and sync outputs of the generator ON and OFF. Gating the outputs OFF forces all outputs to be turned off. Gating the outputs ON turns on all outputs whose individual gating settings are turned ON. The OUTG? query returns the current status of the outputs of the generator.

Command syntax — OUTG *mode*

mode

0 = OFF

1 = ON

Query syntax — OUTG?

Query response — *mode*

Example

```
OUTG 0
ALLU
```


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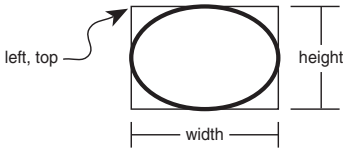
OVAL

draw an OVAL

Class — Custom image primitive

Description — Draws an oval whose axes are parallel to the vertical and horizontal axes of displayed video. The size and position of the oval are defined by its framing rectangle. The framing rectangle is a rectangle whose sides are both tangent to the oval at four points and are parallel to the vertical and horizontal axis of video. It is not drawn as part of the primitive. The figure below shows the relationship of an oval to its framing rectangle.



OVAL uses six parameters. The first is *color*. The next two are the pixel *width* and *height* of the framing rectangle in pixels. The fourth and fifth parameters are the *x, y* coordinates for the top left corner of the framing rectangle. The last parameter is the *fill*.

Command syntax — OVAL *color width height x y fill*

color
available colors

width
total number of horizontal pixels

height
total number of lines

x, y
positive integer numbers

fill
available fill patterns

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
OVAL red 240 150 20 10 GrayPat0  // Draw a red oval 240 pixels wide
                                 // by 150 pixels high. Start framing
                                 // rectangle at X=20, Y=10.
                                 // Fill = none
```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PAGE

draw PAGE of repeating characters

Class
Custom image primitive

Description
Fills a rectangular area (page or block) with a character that repeats horizontally and vertically. The *color* parameter sets the color used to draw the character. The *width* and *height* parameters determine the size of the block to be filled. The *x* and *y* parameters determine the top left corner of the block. The *font* parameter selects which font is used to draw the character. The *character* parameter selects a specific character (by number). For full alphanumeric fonts, the character number is the same as the character's ASCII code number. The spacing between the characters is fixed by the character block size in the font and cannot be changed. Partial characters are not drawn to completely fill the rectangular area; rather, the largest possible block of full characters is centered in the rectangular area.

Command syntax
PAGE *color width height x y font character*

color
available colors

width
width of page in pixels

height
height of page in lines

x
position of left edge of page in pixels

y
position of top edge of page in pixels

font
available fonts

character
min = 0

max = 255

Example

```
PAGE blue 40 30 10 10 opix9 69
// Draw a small block of blue E characters in the upper left corner
```


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PCPG

Pixel Clock Pulse Gate

Class
Format parameter settings

Description
Enables and disables the pixel clock pulse output on generators that have a pixel clock output available. The PCPG? query returns the current setting of PCPG.

Command syntax
PCPG *mode*

mode
0 = OFF

1 = ON

Query syntax
PCPG?

Query response
mode

Other required commands
FMTU or ALLU

Example
```
PCPG 1  // Enable pixel clk output in buffer
FMTU    // Update hardware with format data
```


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PDAU

Pixel Data Analyzer Use

Class	Signal analyzer - Pixel data
Description	Loads the hardware required and copies the patch (static image) from the DVI source to memory. This command is used for the Delta Error Patch test.
Command syntax	PDAU
Example	`PDAU //copies patch from external source to generator memory`
Related commands	GPEL?

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PDSH

Pixel Data Signal Height

Class — Signal analyzer - Pixel data

Description — Sets the height of the patch of pixel data to be analyzed.

Note: *The maximum area (width multiplied by height) of the patch is 1024 pixels.*

Command syntax — PDSH *height*

height
pixel height of patch

Query syntax — PDSH?

Query response — pixel height of patch

Example

```
PDSX 128      //sets patch starting at x-pixel 128
PDSY 256      //sets patch starting at y-pixel 256
PDSH 64       //sets patch height at 64 pixels
PDSW 96       //sets patch width at 90 pixels
PDAU          //captures patch of image
GPEL? 128 256 //read RGB color components at pixel address 128,256
0,255,0
```

Related commands — PDSW, PDSX, PDSY, PDAU

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PDSW

Pixel Data Signal Width

Class
Signal analyzer - Pixel data

Description
Sets the width of the patch of pixel data to be analyzed.

Note: *The maximum area (width multiplied by height) of the patch is 1024 pixels.*

Command syntax
PDSW *width*

width
pixel width of patch

Query syntax
PDSW?

Query response
pixel width of patch

Example

```
PDSX 128      //sets patch starting at x-pixel 128
PDSY 256      //sets patch starting at y-pixel 256
PDSH 64       //sets patch height at 64 pixels
PDSW 96       //sets patch width at 90 pixels
PDAU          //captures patch of image
GPEL? 128 256 //read RGB color components at pixel address 128,256
0,255,0
```

Related commands
PDSH, PDSX, PDSY, PDAU

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PDSX

Pixel Data Signal X Location

Class — Signal analyzer - Pixel data

Description — Controls the x location of the patch data to be analyzed.

Command syntax — PDSX *x*

x
x-coordinate number for patch

Query syntax — PDSX?

Query response — x-coordinate number

Example

```
PDSX 128      //sets patch starting at x-pixel 128
PDSY 256      //sets patch starting at y-pixel 256
PDSH 64       //sets patch height at 64 pixels
PDSW 96       //sets patch width at 90 pixels
PDAU          //captures patch of image
GPEL? 128 256 //read RGB color components at pixel address 128,256
0,255,0
```

Related commands — PDSY, PDSW, PDSH, PDAU

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PDSY

Pixel Data Signal Y Location

Class
Signal analyzer - Pixel data

Description
Controls the y location of the patch data to be analyzed.

Command syntax
PDSY *y*

y
y-coordinate number for patch

Query syntax
PDSY?

Query response
y-coordinate number

Example

```
PDSX 128      //sets patch starting at x-pixel 128
PDSY 256      //sets patch starting at y-pixel 256
PDSH 64       //sets patch height at 64 pixels
PDSW 96       //sets patch width at 90 pixels
PDAU          //captures patch of image
GPEL? 128 256 //read RGB color components at pixel address 128,256
0,255,0
```

Related commands
PDSX, PDSW, PDSH, PDAU

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PELD

PixEL Depth

Class — Format parameter settings

Description — Establishes the number of data bits that represent each active pixel in video memory (frame buffer). The PELD? query returns the current setting of PELD.

Command syntax — PELD *depth*

depth integer

0 = use generator default

4 = 4 bits-per-pixel (16 colors)

8 = 8 bits-per-pixel (256 colors)

32 = 24 bits-per-pixel (16,777,216 colors)

Query syntax — PELD?

Query response — *depth*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
PELD 8  // Select 8 bits-per pixel
ALLU    // Configure hardware and redraw image
```


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PENH

PEN Height

Class	Image editor control
Description	Sets a variable used establish line thicknesses to draw EeRise, NAWC, and Slider test images.
Command syntax	PENH *height* *height integer*
Query syntax	PENH?
Query response	*height*
Example	`PENH 4`

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PENW

PEN Width

Class — Image editor control

Description — Sets a variable used to establish line thicknesses to draw EeRise, NAWC and Slider test images.

Command syntax — PENW *width*

width integer

Query syntax — PENW?

Query response — *width*

Example — `PENW 4`

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PKUP

PacKUP operation related to DMA

Class	System Level
Description	Prepares files for transmission when using the YMDO archiving command
Command syntax	PKUP

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PNAU

Measure Pseudo Noise

Class Signal Analyzer - Pseudo-random noise

Description Loads the hardware required to generate the pseudo noise and measures all the related required parameters.

Command syntax PNAU

Example

```
PNSF 0 //Pseudo-random noise signal format set to CURRENT (internal)
PNST 1 //Pseudo-random noise signal type set to QDI-BCM
PNSA 1 //Pseudo-random noise signal advance set to ACTIVE PIXELS
PNSM 0 //Pseudo-random noise signal mode set to AUTO
PNSP 0 //Pseudo-random noise signal procedure set to CONTINUOUS
PNAU   //Pseudo-random noise generated

CR     //Stop pseudo-random noise

GPER?  //Returns the pixel error rate (in errors per billion)
0.88

GNPT?  //Returns the number of pixels measured (in billions)
4.255

GCET?  //Returns the total number of errors detected on the red, green,
and blue components along with the total number of bad pixels
0,21,0,21

GFED?  //Returns data related to any error (first error only)
40018C,FFFFFF
```

Related commands GPER?, GNPT?, GCET?, GFED?

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PNGU

Pseudo Noise Generator Use

Class — Signal Analyzer - Pseudo-random noise

Description — Loads the hardware required to generate pseudo-random noise (per the latest pseudo-random noise signal settings).

Command syntax — PNGU

Example 1

```
PNSF 1 //Pseudo-random noise signal format set to CURRENT (internal)
PNST 1 //Pseudo-random noise signal type set to QDI-BCM
PNSA 1 //Pseudo-random noise signal advance set to ACTIVE PIXELS
PNSM 0 //Pseudo-random noise signal mode set to AUTO
PNSP 0 //Pseudo-random noise signal procedure set to CONTINUOUS
PNSG 1 //Pseudo-random noise signal gate set to ON
PNGU   //Output Pseudo-random noise using latest parameters
```

Example 2 — To stop pseudo-random noise output:

```
PNSG 0 //Pseudo-random noise signal gate set to OFF
PNGU
```

Related commands — PNSG

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PNSA

Pseudo Noise Signal Advance

Class — Signal Analyzer - Pseudo-random noise

Description — Controls how often pseudo-random noise pixels are calculated.

Command syntax — PSNA *value*

value

0 = every pixel clock

1 = every active pixel clock

Query syntax — PNSA?

Query response — 0 or 1

Example

```
PNSA 1 //Set calculation to pixel every clock
PNGU
```

Related commands — PNGU

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PNSF

Pseudo Noise Signal Format

Class — Signal Analyzer - Pseudo-random noise

Description — Selects the source of timing information used by the various pseudo-random noise parameters.

Command syntax — PNSF *source*

source

0 = CURRENT (timing parameters are based on the internally-generated DVI signal)

1 = MEASURED (timing parameters are based on a measurement of the DVI signal received at the DVI Input connector from an external signal source)

Query syntax — PNSF?

Query response — 0 or 1

Example

```
PNSF 0 // timing parameters are based on internal DVI signal
PNGU
```

Related commands — PNGU

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PNSG

Pseudo Noise Signal Gate

Class — Signal Analyzer - Pseudo-random noise

Description — Gates on or off the output of pseudo-random noise.

Command syntax — PNSG *gate*

gate

0 = Pseudo-random noise is not output (the selected image is output)

1 = Pseudo-random noise is output (replacing the selected image output)

Query syntax — PNSG?

Query response — 0 or 1

Example

```
PNSG 1 //Output pseudo-random noise from the generator
PNGU
```

Related commands — PNGU

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PNSL

Pseudo Noise Signal Length

Class
Signal Analyzer - Pseudo-random noise

Description
Sets the run-length value of the pseudo-random noise sequence.

Command syntax
PNSL *length*

length
hexidecimal number

Query syntax
PNSL?

Query response
run-length value

Example
```
PNSL 4AFFF //set the pseudo-random noise sequence run-length
PNGU
```

Related commands
PNSS, PNGU

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PNSM

Pseudo Noise Signal Mode

Class — Signal Analyzer - Pseudo-random noise

Description — Determines how the pseudo-random noise sequence seed and run-length are determined.

Command syntax — PNSM *mode*

mode

0 = Auto mode. The sequence seed and run-length parameters are set automatically. The seed is automatically set to 0x08000001. Noise values are advanced according to the current setting of the PNSA parameter. If PNSA is set to 0 (every pixel), the sequence length is automatically set to the total number of pixels (per frame) minus one. Alternately, if PNSA is set to 1, noise is advanced every active pixel, and the length is set to the size of the HRES*VRES active area (per frame) minus one.

1 = Manual mode. The sequence seed and run-length must be manually set using the PNSL and the PNSS commands.

Query syntax — PNSM?

Query response — 0 or 1

Example —
```
PNSM 0 //set pseudo-random noise seed and run-length values automatically
PNGU
```

Related commands — PNGU

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PNSP

Pseudo Noise Signal Procedure

Class
Signal Analyzer - Pseudo-random noise

Description
Selects the procedure used when making pseudo-random noise measurements.

PNSP *procedure*

procedure

0 = CONTINUOUS (stop after key press, knob turn, or any I/O). In this mode, noise testing continues until either a key-press, a knob-turn, or serial/GPIB/host I/O port activity is detected. To stop the CONTINUOUS mode remotely via the I/O ports, a “\r” is recommended.

1 = SINGLE SHOT (stop after one run-length). In this mode, a single run-length is executed before the pseudo-random noise measurement is stopped.

n = MULTI SHOT (stop after *n* run-length shots). In this mode, a number of run-lengths (*n*) are executed before pseudo-random noise measurement is stopped and results become available.

Query syntax
PNSP?

Query response
0 - 2

Example

```
PNSP 23 // run 23 sequences of the pseudo-random noise measurement
PNGU
```

Related commands
PNGU

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PNSS

Pseudo-Noise Signal Seed

Class
Signal Analyzer - Pseudo-random noise

Description
Sets the seed value of the pseudo-random noise sequence. A seed value represents a specific pseudo-random noise sequence.

Command syntax
PNSS *seed*

seed
hexidecimal number

Query syntax
PNSS?

Query response
seed value

Example

```
PNSS 8000001 //set pseudo-random noise seed value
PNGU
```

Related commands
PNSL, PNGU

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PNST

Pseudo Noise Signal Type

Class — Signal Analyzer - Pseudo-random noise

Description — Selects the pseudo-random noise algorithm to be used.

Command syntax — PNST *algorithm*

algorithm

0 = T & M algorithm (not supported)

1 = QDI-BCM algorithm

Query syntax — PNST?

Query response — 0 or 1

Example

```
PNST 1 //set QDI-BCM algorithm for pseudo-random noise
PNGU
```

Related commands — PNGU

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PRAT?

Pixel RATe query

Class	Format parameter setting - Video resolution
Description	Returns the current pixel rate setting.
Query syntax	PRAT?
Query response	pixel rate
Example	`PRAT?` `+25.1752E+06`
Related commands	TMAU

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PREG

PRE-emphasis Gate

Class	Format parameter settings
Description	Enables and disables adding pre-emphasis to the Open LVDI digital outputs on generators that support LVDI outputs. The PREG? query returns the current setting of PREG. Pre-emphasis is used to add compensation for signal loss in long cables.
Command syntax	PREG *mode* *mode* 0 = Pre-emphasis OFF 1 = Pre-emphasis ON
Query syntax	PREG?
Query response	*mode*
Other required commands	FMTU or ALLU

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PSHD

Probe Sync Pulse Horizontal Delay

Class — Special Sync Probe Pulse

Description — Sets the delay (in pixels) of the line(s) on which the probe pulse occurs on the special sync output. The PSHD? query returns the current PSHD value.

Command syntax — PSHD *width*

width integer
0=PSVD(HTOT - PSPW-1)

Query syntax — PSHD?

Query response — *width*

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Related commands — PSPG, PSPW, PSPP, PSVD, PSPM

Example

```
PSPG 1      // Enables probe pulse on special sync
PSPP 1      // Sets probe pulse polarity to positive
PSPW 10     // Sets probe pulse width to 10 pixels
PSHD 200    // Sets probe pulse horizontal delay to 200 pixels
PSVD 300    // Sets probe pulse vertical delay to 300 pixels
ALLU        // Applies the settings
```


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PSPG

Probe Sync Pulse Gate

Class — Special Sync Probe Pulse

Description — Enables and disables the probe pulse on the special sync output. The PSPG? query returns the current PSPG mode.

Command syntax — PSPD *mode*

mode integer

0 = OFF

1 = ON

Query syntax — PSPG?

Query response — 0 or 1

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Related commands — PSPP, PSPW, PSHD, PSVD, PSPM

Example

```
FSPG 0      // Disables frame sync
PSPG 1      // Enables probe pulse on special sync
ALLU        // Applies the settings
```


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PSPM

Probe Sync Pulse Mode

Class — Special Sync Probe Pulse

Description — Determines what lines in the frame or field the probe pulse occurs on the special sync output. The PSPM? query returns the current PSPM value.

Command syntax — PSPM *mode*

mode integer

0 = once per frame

1 = every active line in frame

3 = every line in frame

Query syntax — PSPM?

Query response — 0, 1, or 3

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Related commands — PSPG, PSPP, PSPW, PSHD, PSVD

Example

```
PSPG 1      // Enables probe pulse on special sync
PSPP 1      // Sets probe pulse polarity to positive
PSPW 10     // Sets probe pulse width to 10 pixels
PSHD 200    // Sets probe pulse horizontal delay to 200 pixels
PSVD 300    // Sets probe pulse vertical delay to 300 pixels
PSPM 1      // Sets probe pulse to occur on each active line in a frame
ALLU        // Applies the settings
```


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PSPP

Probe Sync Pulse Polarity

Class: Special Sync Probe Pulse

Description: Sets the polarity of the probe pulse on the special sync output. The PSPG? query returns the current PSPP value.

Command syntax: PSPP *polarity*

polarity integer
0 = negative

1 = positive

Query syntax: PSPP?

Query response: 0 or 1

Other required commands: The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Related commands: PSPG, PSPW, PSHD, PSVD, PSPM

Example:

```
PSPG 1      // Enables probe pulse on special sync
PSPP 1      // Sets probe pulse polarity to positive
ALLU        // Applies the settings
```


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PSPW

Probe Sync Pulse Width

Class — Special Sync Probe Pulse

Description — Sets the width in pixels of the probe pulse on the special sync output. The PSPW? query returns the current PSPW value.

Command syntax — PSPW *width*

width integer
1 pixel to (HTOT - 1))

Query syntax — PSPW?

Query response — *width*

Other required commands — The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Related commands — PSPG, PSPP, PSHD, PSVD, PSPM

Example

```
PSPG 1      // Enables probe pulse on special sync
PSPP 1      // Sets probe pulse polarity to positive
PSPW 100    // Sets probe pulse width to 100 pixels
ALLU        // Applies the settings
```


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PSVD

Probe Sync Pulse Vertical Delay

Class
Special Sync Probe Pulse

Description
Sets the line in the frame or field that the probe pulse occurs on the special sync output. The PSVD? query returns the current PSVD value.

Command syntax
PSVD *line*

line integer
0 = PSVD(VTOT-1)

Query syntax
PSVD?

Query response
line

Other required commands
The FMTU command instructs the generator to use the new settings. The ALLU command updates the hardware to the new settings and redraws the test image.

Related commands
PSPG, PSPW, PSPP, PSHD, PSPM

Example

```
PSPG 1      // Enables probe pulse on special sync
PSPP 1      // Sets probe pulse polarity to positive
PSPW 10     // Sets probe pulse width to 10 pixels
PSVD 300    // Sets probe pulse vertical delay to 300 pixels
ALLU        // Applies the settings
```


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PUTA

PUT Absolute

Class — Direct processor control

Description — Writes the specified value *value* into memory at the specified address *address*. The two parameters *address* and *value* are interpreted according to the current setting of BASE (see the BASE command). The number and format of the bits written depend on the current setting of SIZE (see the SIZE command).

Note: *This command is used only with custom applications and command files created by Quantum Data. Indiscriminate use of this command can cause the generator to stop operating and the loss of stored data in non-volatile RAM.*

Command syntax — PUTA *address value*

address

0 to 4,294,967,295 unsigned decimal (BASE = 10)

-2,147,483,648 to 2,147,483,647 (BASE = -10)

0 to FFFFFFFF (BASE = 16)

-80000000 to 7FFFFFFF (BASE = -16)

value

0 to 2^(SIZE)-1

Other required commands — PUTA expects parameters formatted according to the current radix set by the BASE command.

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PUTR

PUT Relative

Class
Direct processor control

Description
Writes the specified value *value* into the location pointed to by the address register (see the ADDR command). The parameter value is interpreted according to the current setting of BASE (see the BASE command). The number and format of the bits written depend on the current setting of SIZE (see the SIZE command). The address register is automatically incremented by SIZE bits after the current location has been written to.

Note: *This command is used only with custom applications and command files created by Quantum Data. Indiscriminate use of this command can cause the generator to stop operating and the loss of stored data in non-volatile RAM.*

Command syntax
PUTR *value*

value
0 to (2^(SIZE))-1

Other required commands
PUTR expects parameters formatted according to the current radix set by the BASE command.

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PXAR?

Pixel Aspect Ratio Query

Class	Format parameter setting - HDMI active video
Description	Reads the aspect ratio of pixels in active regions of the raster image.
Query syntax	PXAR?
Query response	aspect ratio
Related commands	NCPP
Example	`PXAR?` `+1.00000E+00`

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RATC

pixel RATe Calibration factor

Class — System parameter settings

Description — Sets an internal multiplication factor used in setting the pixel clock frequency. The multiplication factor can be set to compensate for the frequency error of the internal reference crystal. Having to use a factor outside of the typical range may indicate a failure of generator's hardware. Reinitializing the generator's memory sets the calibration factor to a factory-default setting of 1.00000.

Note: *The RATC parameter is a system level parameter that will affect the pixel clock frequency of all formats that are recalled. The RATC value will be retained when the generator is powered down and back up again. Query the current setting of RATC if you are experiencing problems with the pixel clock or scan rate being off in frequency.*

Command syntax — RATC *factor*

factor

floating point number equal to calibration factor

typical min = 0.99990

typical max = 1.00010

Query syntax — RATC?

Query response — *factor*

Example

```
RATC 1.00007  // Increases pix clk by factor of 1.00007
```


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RCTL

Reset masked ConTroL bits

Class — Format parameter setting - Digital video signal

Description — Resets the masked control bits for the Broadcom or Silicon Image chip to low. The bits to be reset are (one byte mapped as follows):

CTL13 CTL12 CTL11 CTL10 CTL03 CTL02 CTL01 CTL00

To reset a specific control bit, the mask must account for the current setting of the remaining bits. See example below.

Note: *CTL03 is not part of this resetting. It controls the HDCP.*

Command syntax — RCTL *mask*

mask
hexidecimal

Example

```
SCTL 23  // sets CTL00, CTL01, CTL11 to high
RCTL 22  // resets CTL00 bit to low (0)
```

Related commands — SCTL

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RECT

draw a RECTangle

Class
Custom image primitive

Description
Draws a rectangle whose sides are parallel to the vertical and horizontal axes of displayed video. It uses six parameters. The first is the *color* of the line. The next two parameters are the pixel *width* and *height* of the rectangle. The fourth and fifth parameters are the *x* and *y* coordinates for the top left corner of the rectangle. The last parameter is the *fill*.

Command syntax
RECT *color width height x y fill*

color
available colors

width
total number of horizontal pixels

height
total number of lines

x, y
positive integer numbers

fill
available fill patterns

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
RECT gray50 15 20 50 40 GrayPat50
// Draw a 50% gray rectangle 15 pixels wide and 20 pixels high
// with top left corner at X=50, Y=40 Fill with 50% active pixels

ALLU  // Update hardware to current buffer contents
```


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REDG

RED Gate

Class	Video Gate
Description	Toggles the red video signal gate.
Command syntax	REDG *mode* *mode* 0 = disable 1 = enable
Query syntax	REDG?
Query response	0 or 1
Other required commands	ALLU to invoke the command.
Related commands	BLUG, GRNG
Example	`REDG 0; ALLU  // disable red video component`

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RFLD

Repeat FieLD

Class — Format parameter setting - Video resolution

Description — Determines if identical video information is output for each field of an interlaced (SCAN = 2) format. The RFLD? query returns the current setting of RFLD.

Command syntax — RFLD *mode*

mode

0 = disabled

1 = enabled

Query syntax — RFLD?

Query response — 0 or 1

Other required commands — FMTU or ALLU

Example

```
SCAN 2  // Set Interlaced scanning
RFLD 1  // Enable repeat field buffer
FMTU    // Update hardware with format data
```


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RGBQ?

RGB lut Query

Class LUT Management

Description Returns the current lookup table buffer contents when a lookup table editing session is active (between LUTB and LUTE) and returns the actual lookup table values in the hardware LUT when a lookup table editing session is not active (between LUTE and LUTB).

Query syntax RGBQ? *first_slot slots_returned*

first_slot
first slot number

slots_returned
number of slots to be returned

Query response *slot_number red_level green_level blue_level* crlf

Example
```
LUTB;RGBQ? 0 16
```


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RGBW

RGB Write

Class LUT Management

Description Writes RGB levels to the slot location specified within the current lookup table buffer when a lookup table editing session is active, and writes the levels directly to the LUT hardware when a lookup table editing session is not active.

Command syntax RGBW *slot red_level green_level blue_level*

slot integer

0 to 15 when PELD = 4

0 to 255 when PELD = 8

red_level, green_level, blue_level integer

min = 0

max = LMAX setting (255 nominal)

Related commands RGBQ?

Example

```
LUTE;RGBW 1 255 128 0  // Set slot 1 to an orange color
```


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RMAP

Render MAP

Class
Bitmap image control

Description
Renders a map (icon) at the user-specified coordinates.

Command syntax
RMAP *x y map*

x, y
starting coordinates, positive integer number

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
RMAP 20 5 MyMap     // Renders MyMap at X=20, Y=5
ALLU                // Update hardware to current buffer contents
```


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ROWI

ROW Insert

Class
Bitmap editor function

Description
Inserts a row of pixel data into the bitmap that is being edited. The existing pixel data in the selected row and higher number rows are bumped up one row to make room for the new pixel data.

Command syntax
ROWI *row hexstring*

row integer
min =

max =

hexstring
hexadecimal number

Other required commands
A bitmap editing session must have been opened with a MAPB command.

Example
```
ROWI 1 FFDE54F  // insert new row 1
```


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ROWQ?

bitmap row Query pointer

Class
Bitmap editor function

Description
Returns the pixel data for the given row for the current contents of the bitmap editor buffer.

Query syntax
ROWQ? *row max*

row
positive integer number

max
positive integer number

Query response
Hexstring of one or more characters consisting of 0-9 and A-F.

Other required commands
A bitmap editing session must have been opened with a MAPB command.

Example
```
ROWQ? 1  // Returns pixel data for row 1
```


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ROWY

ROW Yank

Class
: Bitmap editor function

Description
: Deletes a row of pixel data in the bitmap that is being edited. The pixel data in the higher number rows are bumped down one row to fill in the gap.

Command syntax
: ROWY *row*

row
: positive integer

Other required commands
: A bitmap editing session must have been opened with a MAPB command

Example
: `ROWY 2  // Delete the pixel data for row 2`

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SAMP

Digital Audio Sinewave Amplitude

Class — Sonic data generator

Description — Sets the amplitude in decibels of the audio stream sinewave output by the generator.

Command syntax — SAMP *amplitude* (sets all channels)

amplitude

-96.3 to 0 (if NBPA is 16-bits)

-120.4 to 0.0 (if NBPA is 20-bits)

-144.5 to 0.0 (if NBPA is 24-bits)

Query syntax — SAMP?

Query response — *amplitude*

Example —

```
SAMP -60.0                  // Sets all channels to -60 amplitude
FMTU
```

Related commands — SRAT, SMIN?, SMAX?

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SCAL

Self CALibrate

Class	System calibration setting
Description	Causes a generator equipped with self-calibration circuitry to go through its self-calibration cycle.
Command syntax	SCAL

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SCAN

SCAN fields per frame

Class — Format parameter setting - Video resolution

Description — Establishes the number of fields scanned per frame. Set to 1 for progressive (non-interlaced) scan and 2 for interlaced scan. The SCAN? query returns the current setting of SCAN.

Command syntax — SCAN *fields*

fields

1 = progressive (non-interlaced)

2 = interlaced

Query syntax — SCAN?

Query response — *fields*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
SCAN  // Select interlace in buffer
FMTU  // Update hardware to current buffer contents
```


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SCTL

Set masked ConTroL bits

Class DVI TMDS

Description Sets the masked control bits for the Broadcom or Silicon Image DVI transmitter chip. The bits to be set are (one byte mapped as follows):

CTL13 CTL12 CTL11 CTL10 CTL03 CTL02 CTL01 CTL00

Note: *CTL03 is not part of this setting. It controls the HDCP.*

Command syntax RCTL *mask*

mask
hexidecimal

Example
```
SCTL 23 //  the 23 in hex sets the CTL00, CTL01 and CTL11 to 1's
```

Related commands RCTL

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SDIR

Sort DIRectory

Class	Directory editor control
Description	Sorts the names in a directory by alphabetical order.
Command syntax	SDIR
Other required commands	Directory editing session must have been opened with a DIRB command.

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SDLY

Sequence step DeLaY

Class
Sequence editor control

Description
Sets how long a sequence step will pause before advancing to the next step in the auto run mode. A sequence step will use the last value set by the SDLY command. The SDLY? query returns the current setting of SDLY.

Command syntax
SDLY *delay* | *-frames*

delay
Delay time in seconds as a floating point number.

frames
Delay in frames. Type minus (-) character before integer.

min = 0.0 seconds; -1 frame

max = 1.70E38 seconds (infinite)

Query syntax
SDLY?

Query response
delay

Other required commands
SMOD setting must be equal to 3 in order for the SDLY setting to have any affect on sequence operation.

Example

```
SDLY 5.0  // Set delay to five seconds per step
SDLY -3   // Set delay to three frames per step
```


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SDMG

Sonic Data Mixer Gate

Class — Sonic data generator

Description — Configures the generator to use either an internal or external audio source.

Note: *Setting the mask "external" bit to 1 causes the SPDIF audio signal to be passed through the generator. In this case, the Audio InfoFrame CT, CC, SF, and SS parameters are set to 0, indicating that the stream header should be used to determine audio coding type, channel type, sampling frequency, and sample size, respectively. If both "external" and "sdg" bits are set to 1 simultaneously, then an error is generated as the generator's sonic data mixer does not currently support proportional mixing of internal and external sources.*

Important: *Restarting the generator does not change this setting.*

Command syntax — SDMG *mask*

mask

1 = sdg (internal)

2 = external

Example

```
SDMG 1
FMTU
```


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SEOS

Set End Of String

Class GPIB port control

Description Controls how a generator reads strings, when reading multi-line responses. In GPIB communication both the sender and receiver first have to agree on end-of-string parsing. The SEOS command enables users to determine if the generator should use line feed for end-of-string parsing.

Command syntax SEOS *integer*

integer

0 = Configures the generator to not test end-of-strings, and to send EOI only on the last character of the entire response. Use this option to receive an entire multi-line response in a single read operation. Leave the VISA “Enable Termination Character” option set to FALSE.

1 = Use end-of-string testing (default).

Query syntax SEOS?

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SEQA

SEQuence save As

Class — Sequence memory management

Description — Saves the current contents of the sequence edit buffer using the given name.

Command syntax — SEQA *name*

name
A valid MS-DOS filename (8 characters minus any extension)

Example

```
SEQA MY_SEQ  // Save with the name "MY_SEQ"
```


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SEQB

SEQuence editing Begin

Class	Sequence editor control
Description	Marks the beginning of a sequence editing session.
Command syntax	SEQB
Other required commands	Use either a SEQL command to load an existing sequence or a SEQN command to create a new sequence. Use SEQE when ending the editing session.

Example

```
SEQN  // Initialize sequence edit buffer
SEQB  // Start sequence editing session

      // One or more sequence editing commands ...

SEQE  // End sequence editing session
```


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SEQE

SEQuence editing End

Class — Sequence editor control

Description — Marks the end of a sequence editing session.

Command syntax — SEQE

Other required commands — Use SEQB when starting the editing session. Use SEQA or SEQS to save changes.

Example

```
EQB             // Start sequence editing session

                // One or more sequence editing commands ...

SEQE            // End sequence editing session
SEQA MYSEQ_02   // Save edited sequence as "MYSEQ_02"
```


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SEQK

SEQuence Kill

Class — Sequence memory management

Description — Deletes a sequence by name. The query returns a 1 if the named sequence can be deleted. If sequence is read-only or non-existent, the query returns a 0.

Command syntax — SEQK *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — SEQK? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response — 0 or 1

Example

```
SEQK MY_SEQ  // Delete seq called "MY_SEQ"
```


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SEQL

SEQuence Load

Class
Sequence memory management

Description
Copies the sequence having a name equal to *name* from sequence memory into the sequence edit buffer. The query returns a 1 if the named sequence can be loaded; otherwise, a 0 is returned.

Command syntax
SEQL *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax
SEQL? *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query response
0 or 1

Other required commands
An SEQU command must be executed after the SEQL command to start running the sequence.

Example

```
SEQL MY_SEQ  // Load "MY_SEQ" dir in edit buffer
SEQU         // Start running the sequence in the buffer
```


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SEQN

SEQuence New

Class — Sequence editor control

Description — Initializes the sequence edit buffer. The name *name* is assigned as the sequence's name. The query will return the name that has been assigned as the sequence's name.

Command syntax — SEQN *name*

name
optional valid MS-DOS filename (8 characters minus any extension)

Query syntax — SEQN?

Query response — *name*

Example

```
SEQN         // Init edit buffer without assigning a new name
```

or

```
SEQN MY_SEQ  // Init edit buffer with name of "MY_SEQ"
```


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SEQP

SEQuence Path

Class — Sequence memory management

Description — Sets the current sequence path name to a given directory. The query will return the current path name.

Command syntax — SEQP *name*

name
a valid MS-DOS filename (8 characters minus any extension)

Query syntax — SEQP?

Query response — Current sequence path name.

Example

```
SEQP BURN  // Sequences in BURN directory will be listed
```


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SEQQ?

SEQuence Query pointer

Class — Sequence memory management

Description — Returns number sequence names from the list of all the sequence names stored in sequence memory beginning at *index*. The directories are kept in alphanumeric order. The generator maintains internal variables for the current *index* and *number* values. The value of *index* is automatically incremented by *number* after the query is executed. Sending the query with just an *index* parameter, will return the same number of names as the last time, starting at the given index. Sending the query with no parameters will return the next set of names in the directory buffer.

Query syntax — SEQQ? *index number*

index
positive integer number

number
positive integer number

Query response — List of specified sequence names.

Example 1

```
SEQQ? 1 9999  // List the names of all sequences stored in memory
```

Example 2

```
SEQQ? 1 10  // List names of the first ten sequences stored in memory
SEQQ? 21    // List names of the 21st through the 30th sequences
SEQQ?       // List names of the 31st through the 40th sequences
```


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SEQR

SEQuence Read

Class — Sequence memory management

Description — Reads a sequence from the sequence memory location into the sequence buffer. The SEQR command does not run the sequence. The SEQR? query returns the name of the sequence stored in location *location* or returns the string EMPTY if the sequence memory location *location* is empty.

Command syntax — SEQR *location*

location integer

Query syntax — SEQR? *location*

Query response — name

Other required commands — The SEQU command runs the sequence in the buffer.

Example

```
SEQR 5  // Load sequence from RAM location 5
ALLU    // Start using the sequence
```


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SEQS

SEQuence Save

Class	Sequence memory management
Description	Saves the current contents of the generator's sequence edit buffer back to the memory location from which they were originally read.
Command syntax	SEQS

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SEQU

SEQuence Use

Class	Sequence memory management
Description	Runs the sequence currently stored in the sequence edit buffer. The SEQU? query returns the sequence name currently set in the sequence edit buffer.
Command syntax	SEQU
Query syntax	SEQU?
Query response	name
Other required commands	The sequence in the edit buffer must have a non-zero SMOD setting to run.
Example	`SEQL MY_SEQ  // Load "MY_SEQ" dir in edit buffer` `SEQU  // Start running the sequence in the buffer`

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SIZE

SIZE of bit field

Class
Direct processor control

Description
Sets the field size (in base 10) used in connection with the GETA, GETR, PUTA, and PUTR commands. If a negative size is specified, then values given (or returned) are sign extended to 32 bits. For example, if SIZE = -16 and a 16 bit field containing FFFF hex is fetched, then the value FFFFFFFF hex is returned. The SIZE? query returns the current setting of SIZE in base 10. SIZE is preset to 16 each time the generator is powered on.

Note: *This command is used only with custom applications and command files created by Quantum Data.*

Command syntax
SIZE *size*

size
-32 to -1 or 1 to 32 bits

Query syntax
SIZE?

Query response
size

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SLUT

Set Look-Up Table

Class LUT Management

Description Sets up the color look-up-table (LUT) for rendering and displaying selected colors from defined sets. This command is made available for testing low-level drawing firmware and is not intended for use by end users.

Command syntax SLUT *colorset*

colorset integer
Bit mask indicating desired color sets

Example
```
SLUT 65536  // Setup for HUERGB colorset.
```


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SMAX?

Digital Audio Sinewave Maximum

Class	Sonic data generator
Description	Returns the maximum amplitude of the digital audio sinewave output from the generator.
Query syntax	SMAX?
Query response	maximum amplitude (0 - 65,535)
Related commands	SRAT, SAMP, SMIN?

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SMIN?

Digital Audio Sinewave Minimum

Class	Sonic data generator
Description	Returns the minimum amplitude of the digital audio sinewave output from the generator.
Query syntax	SMIN?
Query response	minimum amplitude (0 - 65,535)
Related commands	SRAT, SAMP, SMAX?

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SMOD

Sequence operating MODe

Class
Sequence editor control

Description
Sets the sequence mode. The SMOD? query returns the current setting of SMOD.

Command syntax
SMOD *mode*

mode

0 = disable

1 = enable manual step mode that stops at last step

2 = enable manual step mode that wraps to first step after last step

3 = enable continuous auto stepping

Query syntax
SMOD?

Query response
mode

Other required commands
The SEQL command loads the sequence and SEQU starts to run it.

Example

```
SEQL MY_SEQ  // Load "MY_SEQ" in edit buffer
SEQU         // Start running the sequence in the buffer
SMOD 3       // Set the sequence mode
```


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SNUM

draw sequence Step NUMber

Class
: Custom image primitive

Description
: Displays the sequence step number to an image when drawn as part of a test sequence. The number, along with the word “Step,” appears in a small box. The SNUM command uses three parameters. The first is the *color* used for the text and box border. The next two parameters are the *x* and *y* coordinates for the position of the box.

Command syntax
: SNUM *color x y*

color
: available colors

x, y
: positive integer numbers

Other required commands
: The displaying of sequence step numbers must be enabled with the DNUM command, and the custom image must have been loaded as part of a sequence in order for this primitive to be drawn.

Example
: ```
SNUM white 50 50 // Display seq. num. in box with top left corner at
                  // X=50, Y=50
```



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```

SPAX

slider image SPAcing X

Class — Image editor control

Description — Sets the horizontal spacing of certain elements in some built-in test images. The SPAX? query returns the current SPAX setting.

Command syntax — SPAX *x_spacing*

x_spacing integer
number of pixels

Query syntax — SPAX?

Query response — *x_spacing*

Example — `SPAX 20`

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SPAY

slider image SPAcing Y

Class — Image editor control

Description — Sets the vertical spacing of certain elements in some built-in test images. The SPAY? query returns the current SPAY setting.

Command syntax — SPAY *y_spacing*

y_spacing integer
number of pixels

Query syntax — SPAY?

Query response — *y_spacing*

Example — `SPAY 20`

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SRAT

Digital Audio Sinewave Rate

Class: Sonic data generator

Description: Sets the frequency of the audio sinewave from the generator.

Command syntax: SRAT *rate*

rate
20.0 to 20.0E3 (Hz)

Query syntax: SRAT?

Query response: *rate*

Example:
```
SRAT 10.0E3
FMTU
```

Related commands: SAMP, SMAX?, SMIN?

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SROP

Set/Reset OPeration

Class

Description Sets or resets one or multiple power-on special modes (see GenOps image).

Command syntax SROP *set_mask reset_mask*

set_mask
Value to set.

reset_mask
Value to reset. Use this parameter to establish all bits with one command, or to individually set, or reset bits without changing others.

The mask value is constructed as follows:

Mask value	Description
1	Old format names. Enabling or disabling this mode with re-initialize the generator.
2	Digital friendly
4	Analog friendly
8	Display status on LCD
16	Reset HDCP Rx (Silicon Image friendly mode)
32	Calibrate
64	Clone
128	Key pad
256	Sony baud rate 9600
512	Programmable key pad
1024	Program mode
2048	Digital YC_bC_r mode
4096	DCS Priority mode
8192	HDCP Test mode
16384	Use hot-plug special format mode
32768	DVI mode (disables HDMI mode)
65536	Bypass “hot-plug” format special mode (for DVI and HDMI outputs).

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Query syntax SROP?

Query response Returns current SROP mode. If multiple special modes are enabled, the SROP? value is the sum of the mask values for the enabled modes.

Example 1
```
R:\SROP 8
R:\SROP 2
R:\SROP?

10
```

Example 2
```
SROP 2 // set digital friendly mode
SROP 4 // set analog mode
```

Example 3 For generators with HDMI option:
```
SROP 32768 // Enable DVI mode (disable HDMI mode)
SROP 0 32768 // Enable HDMI mode
```


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SSST

Select Sync Signal Type

Class — Format parameter setting - Synchronization

Description — Selects the type of sync signal used to synchronize the display. In general, any one of three different types of sync can be selected to synchronize the display. The availability of different sync types is specified using the ASCT, DSCT, and DSST commands. Some displays may not accept one (or more) types of sync. For example, a digital video monitor cannot accept analog composite sync because analog signal transmission is not used. Also, a PGA display cannot accept digital separate HS and VS because only one sync wire is provided in the cabling. In these cases, one (or more) of the sync types (ASCT, DSCT, or DSST) is set to 0, indicating that they are not supported. If a non-supported sync type is selected using the SSST command, then the corresponding sync outputs of the generator will remain disabled. The SSST? query returns the type of sync (if any) that is currently selected.

Command syntax — SSST *type*

type

0 = no sync

1 = digital separate horizontal and vertical sync (DHS & DVS)

2 = digital separate composite sync (DCS)

3 = analog composite sync (ACS)

4 = analog composite sync (ACS)

5 = DSS and ACS

6 = DCS and ACS

7 = DSS, DCS, and ACS

8 = DPMS-OFF (DSS)

9 = DPMS-SUSPEND (DSS)

10 = DPMS-STANDBY (DSS)

11 = DCS & DSS

Query syntax — SSST?

Query response — *type*

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Other required commands

The desired sync type selected must not be set to void with the ASCT, DSCT, or DSST commands. To actually output the selected sync signal, it must be gated on with the appropriate ASSG, ASBG, ASGG, ASRG, CSPG, HSPG, and VSPG settings.

Example

```
DSST 1  // Set Amer. H&V in buffer
HSPG 1  // Enable H sync in buffer
VSPG 1  // Enable V sync in buffer
SSST 1  // Select sep H&V sync in buffer
FMTU    // Update hardware to current buffer contents
```


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STRG

STRetchinG SCL Low Signal

Class — EDID and DDC control

Description — Enables a stretching capability for the receiver of the HDMI analyzer. Each time a host accesses the I2C receiver bus (for example, to read the EDID), the receiver stretches the SCL low signal for 5 ms.

Enable stretching for testing purposes only.

Command syntax — STRG *value*

value

0 = deactivate stretching

1 = activate stretching of SCL low signal for 5 ms

Query syntax — STRG?

Query response — 0 or 1

Example —

```
STRG 1
DIDU
```

Related commands — DIDU

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STEP

sequence STEP number

Class
Sequence editor control

Description
Selects a step in the sequence edit buffer. It is context sensitive. While editing a sequence (between SEQB and SEQE commands), the STEP command selects a step to be edited. Outside of the sequence editor and while running a sequence, the command selects a step to be executed.

The STEP? query returns the current setting of STEP.

Command syntax
STEP *step*

step
min = 1

max = See description

Query syntax
STEP?

Query response
step

Other required commands
When running a sequence, the SEQU command must be executed after the STEP command to load the format and display the image selected in the step.

Example
```
STEP 5  // Select fifth step in current sequence
SEQU    // Load format and draw image in current step
```


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SVSG

Single Video Signal Gating

Class Video Gate

Description Determines which output colors are enabled. The SVSG? query returns the current SVSG setting.

Command syntax SVSG *gate_mask*

gate_mask

Gate Mask	Red	Green	Blue
0	Off	Off	Off
1	Off	Off	On
2	Off	On	Off
3	Off	On	On
4	On	Off	Off
5	On	Off	On
6	On	On	Off
7	On	On	On

Query syntax SVSG?

Query response *gate_mask*

Example
```
SVSG 7
```


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SXAR

Signal Aspect Ratio

Class — Format parameter setting - HDMI active video

Description — Sets the natural aspect ratio of the video signal format (or “coded frame”) that transports images to the display.

Command syntax — SXAR *aspect_ratio*

aspect_ratio
0.75 to ˜2.39

Note: *For a listing of established aspect ratios, see the table on page 262 (CXAR command).*

Related commands — CXAR, EXAR

Example

```
SXAR 1.33 // Sets 4:3 video signal aspect ratio for source content
FMTU
```


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SXCX

Signal-From-Content Aperture Map

Class — Format parameter setting - HDMI active video

Description — Sets the proper parameters to values necessary to fit CXAR-shaped image content to the SXAR-shaped aperture of the signal interface timing format.

Upon executing this command, the following actions are performed:

1. The EXAR value is set to the CXAR value (EXAR=CXAR).
2. The EXCX value is set to 0 (EXCX=0).
3. The SXEX value is set to value entered for this command (SXEX=SXCX).

Command syntax — SXCX *code*

code
0 to 131071 (in decimal)

Note: *For help in determining the proper mapping code, follow the procedure on page 318 (EXCX command).*

Related commands — SXEX, EXAR, EXCX, CXAR, SXCX, SXAR

Example —
```
SXCX 264 //Use centered shrink w/black bars top & bottom
FMTU
```


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SXEX

Signal-From-Extended Aperture Map

Class — Format parameter setting - HDMI active video

Description — Maps EXAR-shaped image content into the SXAR-shaped signal interface.

Command syntax — SXEX *code*

code
0 to 131071 (in decimal)

The mapping code is made up of three binary field codes as follows:

- Bits 0-2 are the *Squeeze/Stretch* (“S”) field code
- Bits 3-9 are the *Letterbox/Pillar* (“L”) field code
- Bits 10-16 are the *Safe Area* (“K”) field code

Note: *For help in determining the proper mapping code, follow the procedure on page 318 (EXCX command).*

Related commands — EXAR, SXAR, EXCX, SXCX

Example —
```
SXEX 264 //Use centered shrink w/black bars top & bottom
FMTU
```


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TBOX

draw information Text BOX

Class Custom Image Primitive

Description Renders an information text box that can be added to custom images. This command allows color, position, information, and box type to be customized.

Command syntax TBOX *color %x %y info type*

color
valid color name

%x
0.0 to 1.0 normalized positioning of box center in the x direction

%y
0.0 to 1.0 normalized positioning of box center in the y direction

info
0 = format, image, line-rate, and frame-rate (default =

1 = format

2 = image

3 = sequence

4 = step number

5 = format and image

6 = sequence and step

7 = line-rate and HRES X VRES

8 = pixel-rate and HRES X VRES

9 = format, image, sequence, and step

10 = format, image, HRES X VRES, and pixel rate

11 = line-rate, frame-rate, sequence, and step

12 = pixel-rate, HRES X VRES, sequence, and step

13 = line-rate, frame-rate, pixel-rate, and HRES X VRES

14 = format, image, line-rate, frame-rate, sequence, and step

15 = format, image, HRES X VRES, pixel-rate, sequence and step

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type

0 = text only

1 = text w/ border

2 = text w/ black background

3 = text w/ border and black background

Query syntax TBOX?

Query response *color %x %y info type*

Other required commands TBXG

Example

```
TBOX white 0.5 0.5 8 3
```


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TBXG

Text BoX Gating

Class

Description — Enables and disables the displaying of the text box defined by the TBOX command. The TBXG? query returns the current TBXG mode.

Command syntax — TBXG *mode*

mode integer

0 = OFF

1 = ON

Query syntax — TBXG?

Query response — *mode*

Other required commands — TBOX

Example

```
TBXG 1
```


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TEXT

draw TEXT string

Class
Custom image primitive

Description
Draws a user-defined text string. It uses five parameters. The first is *color*. The next two are the *x* and *y* coordinates for the upper left corner of the starting position of the string. The fourth parameter selects the *font*. The last parameter is the *text* string. If the string is longer than one word, it must be contained inside quotation marks.

All of the characters in the text string must have matching characters in the font selected by font name.

Command syntax
Text *color x y font "text "*

color
available colors

x, y
coordinates of top left corner of page in pixels

font
available fonts

text
approximately 30 characters (must be enclosed by quotes)

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
TEXT red 50 40 opix9 "HELLO WORLD"
     // Draw red "HELLO WORLD" at x=50 y=40 in opix9 font
```


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TMAU

Timing Measurement Analyzer Use

Class DVI signal analyzer

Description Initiates a measurement of the timing received from an external DVI source (via the DVI Input connector). To do this, the PNSF command must be set to MEASURED. Measured parameters are written into the format buffer.

Note: *If PNSF is set to CURRENT, then the TMAU command leaves the parameters of the currently selected format in the format buffer.*

The timing parameters can be read back via queries using the following commands

SCAN?	Returns the scan type
PRAT?	Returns the pixel rate (in Hz)
FRAT?	Returns the frame rate (in Hz)
VRAT?	Returns the vertical (field) rate (VRAT = FRAT * SCAN)
HTOT?	Returns the horizontal total (in pixels)
HRES?	Returns the horizontal active (in pixels)
HSPD?	Returns the horizontal sync pulse delay (in pixels)
HSPW?	Returns the horizontal sync pulse width (in pixels)
HSPP?	Returns the horizontal sync pulse polarity
VTOT?	Returns the vertical total (in lines)
VRES?	Returns the vertical active (in lines)
VSPD?	Returns the vertical sync pulse delay (in lines)
VSPW?	Returns the vertical sync pulse width (in lines)
VSPP?	Returns the vertical sync pulse polarity
HVPD?	Returns the pixel delay between the H and V sync pulses.

Command syntax TMAU

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Example

```
PNSF 1 //Pseudo-random noise signal format set to MEASURED
PNST 1 //Pseudo-random noise signal type set to QDI-BCM
TMAU //Measure external signal's timing format parameters
HTOT? //Read external signal's total number of horizontal pixels
800
HRES? //Read external signal's total number of active horizotan pixels
640
```


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TOBL

set levels relative TO BLanking

Class Custom image primitive

Description Temporarily changes how the signal levels are determined for a given color intensity level. The default method uses black as the 0% reference level and peak video as the 100% level. Inserting TOBL moves the 0% reference point to the blanking (blacker than black) pedestal level. The reference point remains shifted only for as long as the image is displayed.

Command syntax TOBL

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TRIA

draw a TRIAngle

Class
Custom image primitive

Description
Draws a triangle defined by its three end points. The primitive uses eight parameters. The first is line *color*. The next three pairs of parameters are the *x* and *y* coordinates for the three points. The last parameter is the *fill*. More complex filled polygons can be built up using a series of joined filled triangles.

Command syntax
TRIA *color x1 y1 x2 y2 x3 y3 fill*

color
available colors

x1, y1, x2, y2, x3, y3
positive integer number

fill
available fill pattern

Other required commands
The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
TRIA red50 10 5 10 25 40 15 GrayPat50
     // Draw a red50 triangle at x=10,
     // y=5; x=10, y=25; x=40, y=15 with
     // 50% active pixel fill

ALLU // Update hardware to current
     // buffer contents
```


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TTLL

Class:

Description Sets the output voltage of the TTL interface on the 802R-PCI generator. The query reads the current value.

Command syntax TTLL *voltage*

voltage

3.3

5.0

Query syntax TTLL?

Example
```
TTLL 5.0   // sets the output voltage to 5V on the TTL interface
```


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UIDN

User IDeNtification

Class — System parameter settings

Description — Sets up the text string that is placed in the upper portions of the SMPTE133 and Cubes images. The command can be used to add a company name or other identification to the images. The command will not change the text in a currently displayed image; it must be redrawn to use the new text. The factory default string is “Quantum Data.” The UIDN? query returns the current text string.

Command syntax — UIDN *string*

string
text string 80 characters in length

Query syntax — UIDN?

Query response — *string*

Other required commands — The IMGU command redraws the last selected test image. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
UIDN "XYZ Monitor Mfg."  // Change text string
IMGL SMPTE133            // Select image that uses the text string
IMGU                     // Draw the image using new string
```


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UNPK

UnPacK operation related to DMA

Class

Description Unpacks archived data received by the YMDI command and puts it in the proper memory locations

Command syntax UNPK

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USIZ

Unit of measure used for physical SIZes

Class
System control

Description
Sets the units of measure assumed by HSIZ and VSIZ commands to establish the physical size of the image that appears on the CRT (context sensitive; see FMTB and FMTE). The USIZ? query returns the current setting of USIZ.

Note: *Changing the USIZ parameter between inches and millimeters will convert the current HSIZ and VSIZ values to match the new unit of measure. For example, if USIZ is in inches and the current HSIZ is 10 (inches), changing USIZ from inches to mm will change HSIZ to 25.4 (mm). The USIZ command should be sent before specifying physical sizes in format command files.*

Command syntax
USIZ *units*

units

0 = sizes not given (use default)

1 = inches

2 = mm

Query syntax
USIZ?

Query response
units

Other required commands
The ALLU command updates hardware to the new setting and redraws the test image, taking the new units into account.

Example

```
FMTB        // Begin editing session

            // One or more format editing commands ...

USIZ 1      // Select inches as unit of measure in buffer
HSIZ 10.4   // Set width to 10.4 in buffer
VSIZ 7.8    // Set height to 7.8 in buffer
ALLU        // Test the new settings

            // One or more format editing commands ...

FMTE        // End editing session
```


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UNPK

UnPacK operation related to DMA

Class

Description Unpacks archived data received by the YMDI command and puts it in the proper memory locations

Command syntax UNPK

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UNPK

UnPacK operation related to DMA

Class

Description — Unpacks archived data received by the YMDI command and puts it in the proper memory locations

Command syntax — UNPK

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VERF?

VERsion Firmware

Class — Miscellaneous system parameters

Description — Returns the firmware version number for the runtime code and the boot code. The digits to the left of the decimal point represent the major release level. The digits to the right of the decimal point represent the revision number of the release. A second decimal point followed by more digits indicates the revision is at a given beta test level.

Query syntax — VERF?

Query response — *version runtime code: version boot code*

Example —
```
VERF?
20.0882002,01.03.03
```


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VERG?

VERsion Gateware

Class — Miscellaneous system parameters

Description — Returns the gateware version number for the programmable devices. The digits to the left of the decimal point represent the major release level. The digits to the right of the decimal point represent the revision number of the release. A second decimal point followed by more digits indicates the revision is at a given beta test level.

Query syntax — VERG?

Query response — *product code, revision, date code: product code, revsion, date code: product code, revsion, date code*

Example

```
VERG?
250C,16,8022004:250F,60,10052004:0,0,0
```


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VERH?

VERsion Hardware

Class Miscellaneous system parameters

Description Returns a five-digit hardware version number. The number indicates when a major modification to the hardware was last implemented. The significance of each digit is interpreted as follows:

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VRAT?

Vertical RATe Query

Class	Format parameter setting - Video resolution
Description	Returns the current vertical (field) rate. This is equal to the product of the FRAT (frame rate) and SCAN (scan type) settings (FRAT * SCAN).
Query syntax	VRAT?
Query response	vertical field rate
Example	`VRAT? //read the product of FRAT and SCAN settings` `50.0000`
Related commands	TMAU

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VRES

Vertical RESolution

Class — Format parameter setting - Video resolution

Description — Establishes the number of active lines per frame. The VRES? query returns the current setting of VRES.

Command syntax — VRES *lines*

lines

min =

- 1 (when SCAN = 1) or
- 2 (when SCAN = 2)

max = the lesser of

- VTOT-1 (when SCAN = 1) or
- VTOT-3 (when SCAN = 2)

Must be an even number when SCAN = 2.

Query syntax — VRES?

Query response — *lines*

Other required commands — The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
VRES 480  // Set 480 active lines in buffer
ALLU      // Configure hardware and redraw image
```


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VSIZ

Vertical SIZe

Class — Format parameter setting - Video resolution

Description — Establishes the vertical physical size of the image on the display. Units expected (or returned) vary according to the last mode set with USIZ command. The VSIZ command is context sensitive and must appear between begin and end commands FMTB and FMTE. The VSIZ? query returns the current setting of VSIZ.

Note: *Make sure that the USIZ parameter is properly set before using the VSIZ command. Changing the USIZ setting after entering VSIZ will convert the size to match the new unit of measure.*

Command syntax — VSIZ *size*

size
physical size; positive value (floating point accepted)

Query syntax — VSIZ?

Query response — *size*

Other required commands — The units of measure must be properly set by USIZ before entering VSIZ. The ALLU command updates hardware to the new setting and redraws the test image, taking the new size into account.

Example

```
FMTB        // Begin editing session

            // One or more format editing commands ...

USIZ 1      // Select inches as unit of measure in buffer
HSIZ 10.4   // Set width to 10.4 in buffer
VSIZ 7.8    // Set height to 7.8 in buffer
ALLU        // Test the new settings

            // One or more format editing commands ...

FMTE        // End editing session
```


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VSPD

Vertical Sync Pulse Delay

Class — Format parameter setting - Synchronization

Description — Establishes the delay between leading edge of blanking in the first (or even) field and the leading edge of the vertical sync pulse. When interlacing, delay between end of video and leading edge of vertical sync before second (or odd) field is 0.5 line shorter than the whole-line delay specified. The VSPD? query returns the current setting of the vertical sync pulse delay.

Command syntax — VSPD *lines*

lines

min =0 (when SCAN = 1) or 1 (when SCAN = 2)

max = VTOT-VRES-VSPW (when SCAN = 1) or [(VTOT-VRES-1) /2]-VSPW (when SCAN = 2)

Query syntax — VSPD?

Query response — *lines*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
VSPD 11  // Set V sync delay to 11 lines in buffer
FMTU     // Update hardware to current buffer contents
```


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VSPG

Vertical Sync Pulse Gate

Class
Format parameter setting - Synchronization

Description
Enables and disables the digital vertical sync output. The VSPG? query returns the current mode of VSPG.

Command syntax
VSPG *mode*

mode
0 = OFF

1 = ON

Query syntax
VSPG?

Query response
0 or 1

Other required commands
To use digital vertical sync, digital separate H and V sync must be selected with the SSST command. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
VSPG 1  // Enable V sync output in buffer
FMTU    // Update hardware to current buffer contents
```


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VSPP

Vertical Sync Pulse Polarity

Class — Format parameter setting - Synchronization

Description — Establishes the logic sense of the digital vertical sync outputs. Setting polarity to 1 causes the leading edge of vertical sync to be a low-to-high transition. Setting polarity to 0 causes the leading edge of vertical sync to be a high-to-low transition. The VSPP? query returns the current polarity of VSPP.

Command syntax — VSPP *polarity*

polarity

0 = high-to-low transition

1 = low-to-high transition

Query syntax — VSPP?

Query response — 0 or 1

Other required commands — In order to use digital vertical sync, it must be gated on with the VSPG command and digital separate H and V sync must be selected with the SSST command. The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
VSPP 1  // Set active hi V sync in buffer
VSPG 1  // Enable V sync output in buffer
SSST 1  // Select H&V sync type in buffer
FMTU    // Update hardware to current buffer contents
```


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VSPW

Vertical Sync Pulse Width

Class	Format parameter setting - Synchronization
Description	Establishes the width of the vertical sync pulse in lines. If the type specified for the selected sync signal (see SSST, ASCT, DSCT, or DSST commands) is one of the CCIR types, then the actual sync pulse width output by the generator will be 1/2 line shorter than the whole number specified. The VSPW? query returns the current setting of VSPW.
Command syntax	VSPW *lines*
Query syntax	VSPW?
Query response	*lines*
Other required commands	The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.
Example	`VSPW 3  // Set V sync width to 3 lines in buffer` `FMTU   // Update hardware to current buffer contents`

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VTOF

Vdram transfer To Flash

Class

Description

Transfers the current contents (no matter what they are) of the video frame buffer to the Flash EEPROM (if equipped) used to store the operating system firmware.

EPROM data sent to the generator is normally stored temporarily in video VDRAM. If the file transfer is successful, a loader code segment will be placed in CMOS SRAM and jumped to. This code segment will, in turn, transfer the image of the firmware in VDRAM to flash memory, thereby replacing the entire flash memory contents. Following this, the generator will reboot and re-initialize using the new firmware.

Important: *Improper use of the VTOF command will cause permanent malfunctioning of the video generator.*

The VTOF command should be executed only by the Quantum Data ARCHIVE.EXE utility as part of a firmware update operation. On stand-alone generators, the ARCHIVE.EXE utility first copies the new firmware file to the video frame buffer via the serial port. Once the file has been successfully copied to the buffer, the buffer contents are then used to update the Flash EEPROM.

Executing the VTOF command when the video frame buffer does not contain a valid firmware file will cause a permanent malfunctioning of the generator. There is no way to restore the firmware on stand-alone models via the serial or GPIB ports once this has occurred. The stand-alone generator must be returned to Quantum Data or a Quantum Data authorized repair center for reprogramming.

Note: *The firmware may be replaced at least 10,000 times. After that, the generator may require service to replace the flash ROMs.*

Important: *In the unlikely event the power fails while the loader is transferring data from VDRAM to flash memory (this process taking approximately 20 seconds to complete), the generator will appear to be inoperable at the next power-on. To restore operation, the generator must be removed from the system, opened, connected to a computer having a special adapter, and reprogrammed from a binary image file using a special executable program.Is this something the customer can do himself? Or should we advise him to return the generator to the repair center?*

Command syntax

VTOF

Other required commands

YMDI, FLSH

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VTOT

Vertical TOTal lines per frame

Class — Format parameter setting - Video resolution

Description — Establishes the total number of lines per frame. When interlacing (SCAN=2), VTOT must be odd. The VTOT? query returns the current setting of VTOT.

The frame or picture refresh rate is equal to HRAT divided by VTOT.

The field or vertical rate is equal to the frame rate when SCAN = 1 (non-interlaced operation).

The field or vertical rate is equal to twice the frame rate when SCAN = 2 (non-interlaced operation).

Note: *The current version of the firmware does not allow you to directly enter a specific field or frame rate when setting up a format. If your test specifications call for a specific field, frame or vertical refresh rate, enter suitable values for HRAT, SCAN and VTOT to give you the desired rate.*

Command syntax — VTOT *lines*

lines

must be an odd number when SCAN = 2

min =

- 2 @ SCAN=1
- 5 @ SCAN=2

max =

- 801GC-ISA = 4096 @ SCAN=1; 4097 @ SCAN=2
- 801GF-ISA = 4096 @ SCAN=1; 8191 @ SCAN=2
- 801GP = 2048
- 801GC, GX = 4096 @ SCAN=1; 4097 @ SCAN=2
- 801GF = 4096 @ SCAN=1; 8191 @ SCAN=2

Query syntax — VTOT?

Query response — *lines*

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

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Example
```
VTOT 525  // Set total lines//frame to 525 in buffer
FMTU      // Update hardware to current buffer contents
```


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XACR

Audio Clock Recovery Data

Class
Sonic data generator

Description
Sets the N value, and optionally sets the CTS value.

The XACR command takes effect (the new N and CTS values are encoded and transmitted to the receiver) after the packet is gated on (DPTG command) and the hardware has been updated (DPGU command).

Command syntax
XACR *n cts*

n
value of audio clock regeneration

cts
Cycle Time Stamp. If not specified, the hardware will calculate the CTS value.

Related Commands
DPTG, DPGU

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XAFD

AFD Mode Setting

Class — Format parameter setting - HDMI active video

Description — Sets the SXCX, SXEX, EXAR, EXCX, and CXAR parameters to values necessary to support a given AFD code.

Command syntax — XAFD *afd_code*

afd_code
0 to 15

The following table provides a listing of AFD codes and corresponding parameter settings.

Note: *This command will not change the value of SXAR (which remains fixed by the current format). Therefore, the range of allowed AFD values are determined by the value of SXAR in the current format.*

AFD Code	SXAR	CXAR[1]	EXCX[1]	EXAR	SXEX[1]
2	1.33	1.77	0	CXAR	280
	1.77	1.77	0	CXAR	16
3	1.33 or 1.77	1.55	0	CXAR	280
4	1.33 or 1.77	> 1.77	0	CXAR	264
8	1.33	1.33	0	CXAR	0
	1.77	1.33	0	CXAR	0
9	1.33	1.33	0	CXAR	16
	1.77	1.33	0	CXAR	264
10	1.33	1.77	0	CXAR	264
	1.77	1.77	0	CXAR	32
11	1.33	1.55	0	CXAR	264
	1.77	1.55	0	CXAR	264
13	1.33	1.55	0	CXAR	8
	1.77	1.55	8	1.33	264
14	1.33	1.55	8	1.77	264
	1.77	1.55	0	CXAR	8
15	1.33	1.33	8	1.77	264
	1.77	1.33	0	1.33	8

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1. Compound maps involving the EXAR extended aperture and both mapping methods SXEX & EXCX are shown in bold. In these cases, an EXCX–L_{csp} operation is first used to place CXAR-shaped content into the EXAR-shaped extended aperture. This operation is then followed by a SXEX-L_{cbb} operation which finally places the EXAR-shaped extended aperture into the SXAR-shaped output signal aperture.

Related Commands SXCX, SXEX, EXAR, EXCX, CXAR

Example
```
XAFD 11 //set parameters for AFD code 11
FMTU
```


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XAUD

Audio InfoFrame Data

Class — InfoFrame Generator (IFG) parameter

Description — Writes Audio InfoFrame packet data.

Command syntax (individual parameter) — XAUD:*audparameter value*

Command syntax (complete packet) — For uncompressed audio coding type:

XAUD *type version length* [*CC* [1 [*SS* [*SF* [*CA* [*LSV* [*DMI*]]]]]]]

For compressed audio coding types:

XAUD *type version length* [*CC* [*CT* [*SS* [*SF* [*MBR* [*CA* [*LSV* [*DMI*]]]]]]]

type
4

version
1

length (bytes)
10

The remaining are Audio Infoframe data parameters (*audparameter*) as specified in EIA/CEA-861-B standard, Section 6.3:

VERS (same as *Version*)
Infoframe version

CC
Channel count (see EIA/CEA-861-B standard, Table 19 for settings)

CC2	CC1	CC0	Audio channel count
0	0	0	Refer to Stream Header
0	0	1	2ch
0	1	0	3ch
0	1	1	4ch
1	0	0	5ch
1	0	1	6ch
1	1	0	7ch
1	1	1	8ch

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CT

Audio coding type (see EIA/CEA-861-B standard, Table 19 for settings)

CT3	CT2	CT1	CT0	Audio Coding Type
0	0	0	0	Refer to Stream Header
0	0	0	1	IEC60958 PCM [26, 27]
0	0	1	0	AC-3
0	0	1	1	MPEG1 (Layers 1 & 2)
0	1	0	0	MP3 (MPEG 1 Layer 3)
0	1	0	1	MPEG2 (multichannel)
0	1	1	0	AAC
0	1	1	1	DTS
1	0	0	0	ATRAC

SS

Sample size (see EIA/CEA-861-B standard, Table 20 for settings)

SS1	SS0	Sample Size
0	0	Refer to Stream Header
0	1	16 bit
1	0	20 bit
1	1	24 bit

SF

Sampling frequency (see EIA/CEA-861-B standard, Table 20 for settings)

SF2	SF1	SF0	Sampling Frequency
0	0	0	Refer to Stream Header
0	0	1	32 kHz
0	1	0	44.1 kHz (CD)
0	1	1	48 kHz
1	0	0	88.2 kHz
1	0	1	96 kHz
1	1	0	176.4 kHz
1	1	1	192 kHz

MBR

Maximum bit rate (this setting multiplied by 8KHz represents the maximum bit rate of the audio stream)

CA

Channel assignment code (see EIA/CEA-861-B standard, Table 22 for settings)

Note: *Setting the XAUD:CA value will automatically set both* DACA *and* DAXA *to corresponding values. See the table on page 271 to view these settings.*

CA								Channel Number							
7	6	5	4	3	2	1	0	8	7	6	5	4	3	2	1

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CA								Channel Number							
0	0	0	0	0	0	0	0	-	-	-	-	-	-	FR	FL
0	0	0	0	0	0	0	1	-	-	-	-	-	LFE	FR	FL
0	0	0	0	0	0	1	0	-	-	-	-	FC	-	FR	FL
0	0	0	0	0	0	1	1	-	-	-	-	FC	LFE	FR	FL
0	0	0	0	0	1	0	0	-	-	-	RC	-	-	FR	FL
0	0	0	0	0	1	0	1	-	-	-	RC	-	LFE	FR	FL
0	0	0	0	0	1	1	0	-	-	-	RC	FC	-	FR	FL
0	0	0	0	0	1	1	1	-	-	-	RC	FC	LFE	FR	FL
0	0	0	0	1	0	0	0	-	-	RR	RL	-	-	FR	FL
0	0	0	0	1	0	0	1	-	-	RR	RL	-	LFE	FR	FL
0	0	0	0	1	0	1	0	-	-	RR	RL	FC	-	FR	FL
0	0	0	0	1	0	1	1	-	-	RR	RL	FC	LFE	FR	FL
0	0	0	0	1	1	0	0	-	RC	RR	RL	-	-	FR	FL
0	0	0	0	1	1	0	1	-	RC	RR	RL	-	LFE	FR	FL
0	0	0	0	1	1	1	0	-	RC	RR	RL	FC	-	FR	FL
0	0	0	0	1	1	1	1	-	RC	RR	RL	FC	LFE	FR	FL
0	0	0	1	0	0	0	0	RRC	RLC	RR	RL	-	-	FR	FL
0	0	0	1	0	0	0	1	RRC	RLC	RR	RL	-	LFE	FR	FL
0	0	0	1	0	0	1	0	RRC	RLC	RR	RL	FC	-	FR	FL
0	0	0	1	0	0	1	1	RRC	RLC	RR	RL	FC	LFE	FR	FL
0	0	0	1	0	1	0	0	FRC	FLC	-	-	-	-	FR	FL
0	0	0	1	0	1	0	1	FRC	FLC	-	-	-	LFE	FR	FL
0	0	0	1	0	1	1	0	FRC	FLC	-	-	FC	-	FR	FL
0	0	0	1	0	1	1	1	FRC	FLC	-	-	FC	LFE	FR	FL
0	0	0	1	1	0	0	0	FRC	FLC	-	RC	-	-	FR	FL
0	0	0	1	1	0	0	1	FRC	FLC	-	RC	-	LFE	FR	FL
0	0	0	1	1	0	1	0	FRC	FLC	-	RC	FC	-	FR	FL
0	0	0	1	1	0	1	1	FRC	FLC	-	RC	FC	LFE	FR	FL
0	0	0	1	1	1	0	0	FRC	FLC	RR	RL	-	-	FR	FL
0	0	0	1	1	1	0	1	FRC	FLC	RR	RL	-	LFE	FR	FL
0	0	0	1	1	1	1	0	FRC	FLC	RR	RL	FC	-	FR	FL
0	0	0	1	1	1	1	1	FRC	FLC	RR	RL	FC	LFE	FR	FL

LSV

Level shift value (see EIA/CEA-861-B standard, Table 23 for settings)

LSV3	LSV2	LSV1	LSV0	Level Shift Value
0	0	0	0	0dB
0	0	0	1	1dB
0	0	1	0	2dB
0	0	1	1	3dB
0	1	0	0	4dB
0	1	0	1	5dB
0	1	1	0	6dB
0	1	1	1	7dB
1	0	0	0	8dB
1	0	0	1	9dB
1	0	1	0	10dB
1	0	1	1	11dB
1	1	0	0	12dB
1	1	0	1	13dB

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LSV3	LSV2	LSV1	LSV0	Level Shift Value
1	1	1	0	14dB
1	1	1	1	15dB

DMI

Down-mix inhibit (see EIA/CEA-861-B standard, Table 24 for settings)

DM_INH	Describes whether the down mixed stereo output is permitted
0	Permitted or no information about any assertion of this
1	Prohibited

Query syntax XAUD:*audparameter*?

Query response *value*

Example 1 The following example sets the number of audio channels (*CC* parameter) to 2 in the Audio Infoframe.

```
XAUD:CC 2
IFGU
```

Example 2 The following example sets an Audio InfoFrame with these properties:

- Seven channels (*CC* parameter)
- MPEG1 coding type (*CT* parameter)
- 16-bit sample size (*SS* parameter)
- 88.2KHz frequency (*SF* parameter)
- 72KHz maximum bit rate (*MBR* parameter)
- All but channel 3 (LFE) are allocated (*CA* parameter)
- 10dB attenuation during source device down-mixing (*LSV* parameter)
- Down-mixing permitted (*DMI* parameter)

```
XAUD 4 1 10 6 3 1 4 9 18 10 0;IFGU
```

Example 3 The following example reports the current setting for the Member Bit Rate parameter in the Audio Infoframe.

```
XAUD:MBR?
```

Related commands IFTR, IFTG, IFGU, DAXA, DACA

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XAVI

Auxiliary Video Information InfoFrame Data

Class — InfoFrame Generator (IFG) parameter

Description — Writes Auxiliary Video Information (AVI) InfoFrame packet data.

Command syntax (individual parameter) — XAVI:*aviparameter value*

Command syntax (complete packet–version 1) — XAVI *type version length* [*S* [*B* [*A* [*Y* [*R* [*M* [*C* [*SC* [*ETB* [*SBB* [*ELB* [*SRB*]]]]]]]]]]]

Command syntax (complete packet–version 2) — XAVI *type version length* [*S* [*B* [*A* [*Y* [*R* [*M* [*C* [*SC* [*ETB* [*SBB* [*ELB* [*SRB* [VIC [PR]]]]]]]]]]]]

type
2

version
1 = version 1
2 = version 2

length (bytes)
13

The remaining are AVI Infoframe data parameters (*aviparameter*) as specified in EIA/CEA-861-B standard, Section 6.1:

VERS (same as *Version*)
Infoframe version:
1 = version 1
2 = version 2

S
Scan information (see EIA/CEA-861-B standard, Table 8 for settings)

S 1	**S 0**	**Scan Information**
0	0	No Data
0	1	Overscanned (television)
1	0	Underscanned (com-puter)
1	1	Future

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B

Bar information (see EIA/CEA-861-B standard, Table 8 for settings)

B 1	B 0	Bar Information
0	0	Bar data not valid
0	1	Vertical Bar info valid
1	0	Horizontal Bar info valid
1	1	Vertical & Horizontal Bar info valid

A

Active Format Information (AFD) present (see EIA/CEA-861-B standard, Table 8 for settings)

A 0	Active Format Information Present
0	No data
1	Active format information valid

Y

Video type (see EIA/CEA-861-B standard, Table 8 for settings)

Y 1	Y 0	RGB or YCbCr
0	0	RGB (default)
0	1	YCbCr 4:2:2
1	0	YCbCr 4:4:4
1	1	Future

R

Active Format Aspect Ratio (ADF value) (see EIA/CEA-861-B standard, Table 9 for settings)

R 3	R 2	R 1	R 0	Active Format Aspect Ratio
1	0	0	0	Same as picture aspect ratio
1	0	0	1	4:3 (Center)
1	0	1	0	16:9 (Center)
1	0	1	1	14:9 (Center)
other values				Per DVB AFD active_format field

M

Picture Aspect Ratio (see EIA/CEA-861-B standard, Table 9 for settings)

M 1	M 0	Picture Aspect Ratio
0	0	No data
0	1	4:3
1	0	16:9

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M 1	M 0	Picture Aspect Ratio
1	1	Future

C

Colorimetry (see EIA/CEA-861-B standard, Table 9 for settings)

C 1	C 0	Colorimetry
0	0	No data
0	1	SMPTE 170M ITU601
1	0	ITU709
1	1	Future

SC

Non-uniform Picture Scaling (see EIA/CEA-861-B standard, Table 11 for settings)

SC 1	SC 0	Non-Uniform Picture Scaling
0	0	No known non-uniform scaling
0	1	Picture has been scaled horizontally
1	0	Picture has been scaled vertically
1	1	Picture has been scaled horizontally and vertically

ETB

Line number of end of top bar representing the last line of a horizontal letterbox bar area at the top of the picture (0 = no horizontal bar present at top of picture).

SBB

Line number of start of bottom bar representing the first line of a horizontal letterbox bar area at the bottom of the picture.

ELB

Pixel number of end of left bar representing the last horizontal pixel of a vertical pillar-bar area at the left side of the picture (0 = no vertical bar present at left of picture).

SRB

Pixel number of start of right bar representing the first horizontal pixel of a vertical pillar-bar area at the left side of the picture.

VIC

Video Format Identification Codes (see DVIC for settings).

PR

Pixel repetition for “2x” and “4x” formats (see EIA/CEA-861-B standard, Table 14 for settings) This field is set automatically based on settings for NCPP and NPPP.

PR 3	PR 2	PR 1	PR 0	Pixel Repetition for Optional (2880)
0	0	0	0	No Repetition (i.e. pixel sent once)
0	0	0	1	Pixel sent 2 times (i.e. repeated once)

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PR 3	PR 2	PR 1	PR 0	Pixel Repetition for Optional (2880)
0	0	1	0	Pixel sent 3 times
0	0	1	1	Pixel sent 4 times
0	1	0	0	Pixel sent 5 times
0	1	0	1	Pixel sent 6 times
0	1	1	0	Pixel sent 7 times
0	1	1	1	Pixel sent 8 times
1	0	0	0	Pixel sent 9 times
1	0	0	1	Pixel sent 10 times

Query syntax XAVI:*aviparameter*?

Query response *value*

Example 1 The following example sets the scan information (*S* parameter) to overscanned in the AVI Infoframe.

```
XAVI:S 1
IFGU
```

Example 2 The following example sets the AFD flag (*A* parameter) to not present and the picture aspect ratio (*M* parameter) to 4:3 in the AVI Infoframe.

```
XAVI: A 0; M 1;IFGU
```

Example 3 The following example sets an Audio InfoFrame (version 2) with these properties:

- Overscanned (*S* parameter)
- Bar information not valid (*B* parameter)
- Active format information valid (*A* parameter)
- YC_bC_r video type (*Y* parameter)
- Active format aspect ratio same as picture format ratio (*R* parameter)
- 4:3 picture aspect ratio (*M* parameter)
- SMPTE 170M colorimetry (*C* parameter)
- No known non-uniform scaling (*SC* parameter)
- No specified line number for horizontal bar (*ETB* and *SBB* parameters)
- No specified pixel number for vertical bar (*ELB* and *SRB* parameters)
- 480p59 video format (*VIC* format)
- No pixel repetition (*PR* format)

```
XAVI 2 1 13 1 0 1 2 8 1 1 0 0 0 0 0 2 0;IFGU
```


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Example 4 The following example reports the current settings for the following AVI Infoframe parameters:

- Video Type
- Active Format Information present
- Bar information present
- Scan information
- Colorimetry

```
XAVI:Y?
XAVI:A?
XAVI:B?
XAVI:S?
XAVI:C?
```

Related commands DVIC, NPPP, IFTR, IFTG, IFGU

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XBBH

Arbitrary Bottom Border Height

Class — Format parameter setting - HDMI active video

Description — Establishes the first line of a horizontal letterbox bar area at the bottom of the image.

Command syntax — XBBH *line_number*

line_number
0 to 65535 (in decimal)

Related commands — XLBW, XRBW, XTBH

Example

```
XBBH 769
FMTU
```


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XDID

EDID Data Write

Class — EDID and DDC control

Description — Writes new EDID structure for DVI Analyzer receiver.

Command syntax — XDID *offset bytes data*

offset (hex)
address offset (in bytes)

bytes
number of bytes (hex)

data
data (hex)

Example 1 — To change the first 3 bytes of the EDID structure (after the header):

```
XDID 8 3 DE33FF
DIDU
```

Example 2 — To write at offset 256 (start of block 2):

```
XDID 100 8 1122334455667788
XDID 108 8 8899AABBCCDDEEFF
DIDU
```

Related commands — DIDU

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XGCP

General Control Parameter Data

Class — Data island packet generator

Description — Enables and disables the HDMI Audio/Video Mute (AVMUTE) feature. When enabled, audio and video are muted by the generator.

Important: *You can set either the AVMUTE set flag (to turn mute on) or the AVMUTE clear flag (to turn mute off) to 1 (but not both).*

Note: *The status of the mute is changed only after the packet is gated ON* (DPTG)*, the repeat mode has been set* (DPTR)*, and the hardware has been updated* (DPGU) *(see example below).*

Command syntax — XGCP *AVMUTE_set_flag AVMUTE_clear_flag*

AVMUTE_set_flag

0 = off

1 = on

AVMUTE_clear_flag

0 = off

1 = on

Related commands — MUTE, DPTG, DPGU

Example 1 — To enable AVMUTE:

```
DPTG 7
DPTR 1
XGCP 1 0
DPGU
```

Once executed, use the MUTE? to continuously check until the AVMUTE state is changed (may not take place right away).

Example 2 — To disable AVMUTE:

```
DPTG 7
DPTR 1
XGCP 0 1
DPGU
```

Again, use the MUTE? command to continuously check until the AVMUTE state is changed.

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XGDP

Generic Data Packet Data

Class: Data island packet generator

Description: Writes a generic data packet for sourcing highly-customized arbitrary data.

Command syntax (individual parameter): XGDP:*gdpparameter value*

Command syntax (complete packet): XGDP *data*

*data (*ASCII)

hexidecimal payload data in the form of ASCII characters (“0” through “F”)—each representing one 4-bit nibble of data (if less than 60 ASCII characters, which is less than 30 bytes of data, are specified, then the remaining bytes are set to zero)

The following are data island packet parameters (*gdpparameter*) as specified in HDMI specification, Section 5.3.

hb0

Packet type (see HDMI specification, Section 5.3.1 through 5.3.6 for settings)

hb1

Packet-specific data (see HDMI specification, Section 5.3.1 through 5.3.6 for settings)

hb2

Packet-specific data (see HDMI specification, Section 5.3.1 through 5.3.6 for settings)

pb0 – pb27

InfoFrame packet data (see HDMI specification, Section 5.3.5 for settings)

Example

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XGIF

Generic InfoFrame Data

Class — InfoFrame Generator (IFG) parameter

Description — Writes generic InfoFrame packet data. This allows you to emulate any InfoFrame type (including vendor-specific).

Note: *The HDMI specification (section 5.2.3.2) requires that an HDMI packet must be transmitted at least every two VSYNC periods, or the receiver will drop out of HDMI mode. A Generic InfoFrame packet can be used for this purpose by enabling its repeat bit (see the IFTR command).*

Command syntax — XGIF *type version length data*

type
0 to 255

version
0 to 255

length (bytes)
0 to 25 (bytes)

data (ASCII)
hexidecimal payload data in the form of ASCII characters—each representing one 4-bit nibble of data (if less than 50 ASCII characters, which is less than 30 bytes of data, are specified, then the remaining bytes are set to zero)

Example — The following example writes 10 bytes of generic InfoFrame data. The remaining bytes 11-25 will be set to zero.

```
XGIF 6 1 20 1122EE4455BB77FF99AA
```

Related commands — IFTR, IFTG, IFGU

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XLBW

Arbitrary Left Border Width

Class — Format parameter setting - HDMI active video

Description — Establishes the last horizontal pixel of a vertical pillar-box bar area at the left side of the image.

Command syntax — XLBW *pixel_number*

pixel_number
0 to 65535 (in decimal)

Related commands — XBBH, XRBW, XTBH

Example

```
XLBW 64
FMTU
```


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XMPG

MPEG InfoFrame Data

Class — InfoFrame Generator (IFG) parameter

Description — Writes MPEG InfoFrame packet data.

Command syntax (individual parameter) — XMPG: *mpgparameter value*

Command syntax (complete packet) — XMPG *type version length* [*MB* [*MF* [*FR*]]]

type
5

version
1

length (bytes)
10

The remaining are MPEG Infoframe data parameters (*mpgparameter*) as specified in EIA/CEA-861-B standard, Section 6.4:

VERS (same as *Version*)
Infoframe version

MB
MPEG bit rate (Enter rate in Hertz [Hz]) [In decimal or hex??]

MF
MPEG frame (see EIA/CEA-861-B standard, Table 26 for settings)

FR
Field repeat (see EIA/CEA-861-B standard, Table 26 for settings)

Query syntax — XMPG:*mpgparameter?*

Query response — *value*

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XRBW

Arbitrary Right Border Width

Class — Format parameter setting - HDMI active video

Description — Establishes the first horizontal pixel of a vertical pillar-bar area at the right side of the image.

Command syntax — XRBW *pixel_number*

pixel_number
0 to 65535 (in decimal)

Related commands — XLBW, XTBH, XBBH

Example

```
XRBW 961
FMTU
```


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XRES

X axis RESolution for custom images

Class — Image editor control

Description — Sets the width factor used to scale horizontal size and position parameters in the primitives of a custom image in the image editor buffer. The XRES? query returns the current XRES setting.

Command syntax — XRES *width*

width integer
16 to 65,536

Query syntax — XRES?

Query response — *width*

Example

```
XRES 1600  // Set horizontal scaling factor to 1600
YRES 900   // Set vertical scaling factor to 900
```


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XSPD

Source Product Description InfoFrame Data

Class — InfoFrame Generator (IFG) parameter

Description — Writes Source Product Description InfoFrame packet data.

Command syntax (individual parameter) — XSPD: *spdparameter value*

Command syntax (complete packet) — XSPD *type version length* [*VNS* [*PDS* [*SDI*]]]

type
3

version
1

length (bytes)
25

The remaining are Source Product Description Infoframe data parameters (*spdparameter*) as specified in EIA/CEA-861-B standard, Section 6.2:

VERS (same as *Version*)
Infoframe version

VNS
Vendor name string

PDS
Product description string

SDI
Source device information (see EIA/CEA-861-B standard, Table 17 for settings)

Query syntax — XSPD:*spdparameter*?

Query response — *value*

Example — The following example sets the vendor name string (*VNS* parameter) to “QDI” in the Source Product Description Infoframe.

```
IFGU
XSPD:VNS QDI
```


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Example 2 The following example specifies a Source Product Description InfoFrame with these properties:

- Vendor name is QDI
- Product description is HDMI-Analyzer
- Source device is Digital STB (1)

```
XSPD 3 1 25 QDI HDMI-Analyzer 1
```

Example 3 The following example reports the current setting for the Product Description parameter in the Source Product Description Infoframe.

```
XSPD:PDS?
```


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XTBH

Arbitrary Top Border Height

Class AFD control parameter

Description Establishes the last line of a horizontal letterbox bar area at the top of the image.

Command syntax XTBW *line_number*

line_number
0 to 65535

Related commands XLBW, XRBW, XBBH

Example
```
XTBH 15
FMTU
```


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XVSG

Video Signal Gating

Class — Format parameter settings

Description — Determines which video outputs are active when the format is selected. The same command controls both the analog and digital video outputs.

Command syntax — XVSG *red_mode, green_mode, blue_mode*

red_mode, green_mode, blue_mode

0 = OFF

1 = ON

Other required commands — The FMTU command instructs the generator to use the new setting. The ALLU command updates hardware to the new setting and redraws the test image.

Example

```
XVSG 1 1 1  // Enable all color channels
FMTU        // Update hardware to current buffer contents
```


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YMDI

Y MoDem Input

Class System Level

Description Initiates the YMODEM-BATCH file-upload protocol.

Customization data stored in a battery-powered NVRAM should be backed-up on a PC so, if a battery failure or other problem occurs, recovery will be possible without having to re-enter data by hand.

Restoration can be accomplished in three ways:

- By sending parameters one-at-a-time
- By host port binary data transfer
- By standard YMODEM-BATCH file-upload protocol.

The YMDI command is used to initiate the YMODEM-BATCH file-upload protocol. The protocol allows one (or more) data structures to be reinstated in the generator from a binary file. A file contains all instances of a particular type of data. For example, sending the FORMAT.MEM file to the generator will restore all user-defined formats. Note that you should not attempt to restore the system parameters by sending SYSTEM.SYS. The YMDI command internally executes UNPK after all files have been received, so UNPK does not need to be sent after YMDI. The YMDI command can also be used to change the firmware in the generator's flash EPROM via the serial port. This is accomplished by sending the FIRMWARE.BIN file to the generator using a YMODEM-BATCH. The generator temporarily places the FIRMWARE.BIN data in picture memory and, if received intact, eventually transfers this binary image to flash memory by internally executing the VTOF function. Note that you do not have to send VTOF after a YMDI firmware upload.

Command syntax YMDI *filenamesIs this the correct representation of the syntax? It doesn't match the example.*

filenames

valid YMODEM-BATCH filenames:

DIR.MEM

PATH.MEM

IMAGE.MEM

SEQUENCE.MEM

FONT.MEM

FORMAT.MEM

FIRMWARE.BIN

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Related commands YMDO, UNPK, PKUP, VTOF, FLSH

Example `YMDI YMODEM-BATCH upload`

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YMDO

Y MoDem Output

Class — System Level

Description — Initiates the YMODEM-BATCH file extraction protocol.

Customization data stored in a battery-powered NVRAM should be backed-up on a PC so that, if a battery failure or other problem occurs, recovery will be possible without having to re-enter data by hand.

Backup can be accomplished in three ways:

- By loading and querying parameters one-at-a-time
- Extracting binary data using the host port
- By standard YMODEM-BATCH file-extraction protocol

The YMDO command is used to initiate the YMODEM-BATCH file extraction protocol. The protocol allows one (or more) data structures to be extracted from the generator as binary files. Each file contains all instances of a particular type of data. For example, the FORMAT.MEM file contains all of the user-defined formats stored in the generator. Note that ALL will cause all files except SYSTEM.SYS and FIRMWARE.BIN to be extracted. YMDO internally executes PKUP before sending files, so PKUP does not need to be sent before YMDO.

Command syntax — YMDO *filename* [*filename* […]] | ALL YMODEM-BATCH download

filename

Valid filename (listed below) or ALL

DIR.MEM

PATH.MEM

IMAGE.MEM

SEQUENCE.MEM

FONT.MEM

FORMAT.MEM

SYSTEM.SYS

FIRMWARE.BIN

Related commands — YMDI, PKUP, UNPK

Example — `YMDO ALL YMODEM-BATCH download`

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YRES

Y axis RESolution for custom images

Class — Image editor control

Description — Sets the height factor used to scale vertical size and position parameters in the primitives of a custom image in the image editor buffer. The YRES? query returns the current YRES setting.

Command syntax — YRES *height*

height integer
16 to 65,536

Query syntax — YRES?

Query response — *height*

Example

```
XRES 1600  // Set horizontal scaling factor to 1600
YRES 900   // Set vertical scaling factor to 900
```

Example

```
dirn mydir      // create a directory named mymap
dirb            // begin directory context
nami 1 smpte133 // insert the name smpte133 at index 1
nami 2 flat     // insert the name flat at index 2
nami 3 raster   // insert the name raster at index 3
dire            // end directory context
dirs            // save map named mymap
dirl mydir      // load directory mydir into edit buffer
dirb            // begin directory context
namq? 1 10      // list mydir names
namy 2          // yank name at index 2
nami 1 colorbar // insert new name at index 1
dire            // end directory context
dira newdir     // save modified mydir as newdir
dirq? 1 10      // list available directories
                // (up to 10 maps starting with the 1st)
```


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B Image Reference

Topics in this appendix:

- Standard image descriptions

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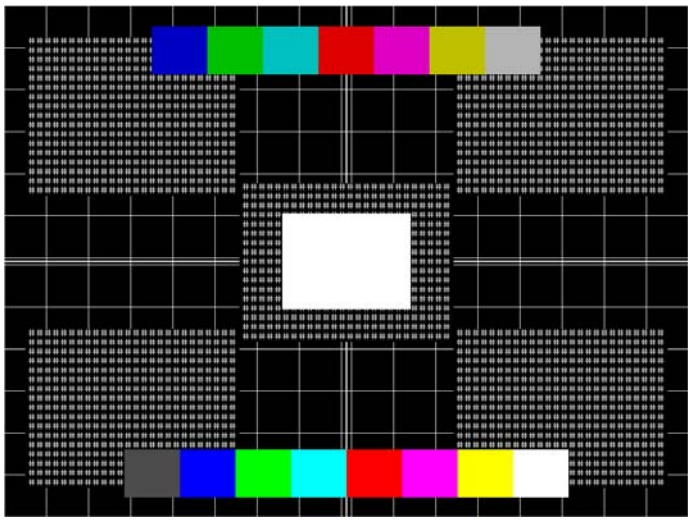
Standard image descriptions

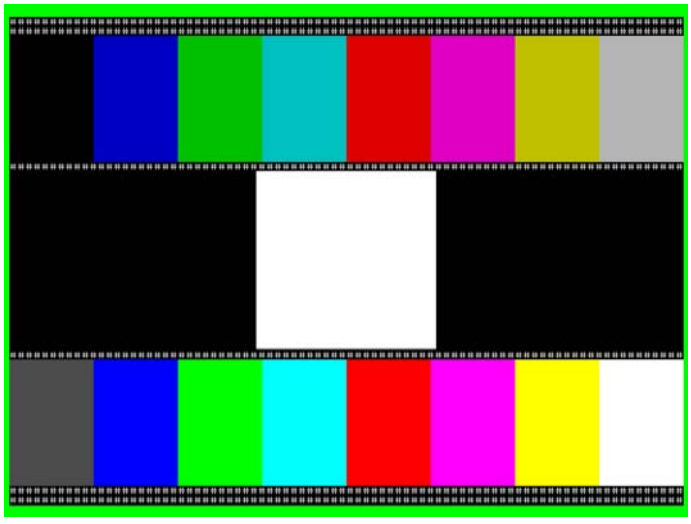
Acer1

Description Special test image developed per customer specifications. Consists of two sets of color bars and five blocks of “#” characters on a white crosshatch with a black background.



Acer2

Description Special test image developed per customer specifications. Consists of colorbars, lines of “#” characters, and a green border.



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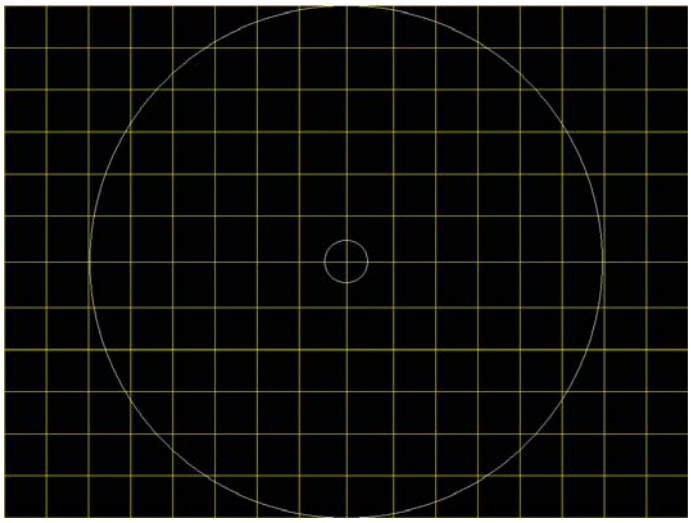
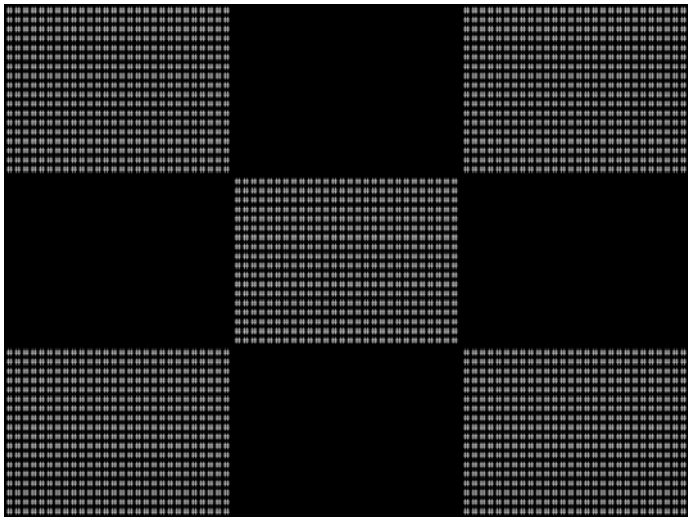
Acer3, Acer4, Acer5 and Acer6

Description Special test images developed per customer specifications. Consists of large and small white circles centered on either a yellow (Acer3), magenta (Acer4), cyan (Acer5), or white (Acer6) crosshatch on a black background. The Acer3 image is shown below.



Acer7 and Acer8

Description Special test image developed per customer specifications. In the primary version, five blocks of either white “#” (Acer7) or “H” (Acer8) characters on a black background are displayed. A secondary version displays black characters on a white background. The Acer7 image is shown below.



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Acer9

Description Special test image developed per customer specifications. In the primary version, a mostly white field is displayed with two rows of color bars at the bottom. A secondary version displays a black field with the two rows of color bars at the bottom.

AFDtest

Description Used to test HDMI content mapping using different EIA/CEA-861-B formats. There are 10 different versions of this image. For more information, see “Testing with Active Format Description (AFD)” on page 162.

Analyzer

Description Used to configure the DVI and HDMI analyzer. For more information, see Chapter 8, “Analyzing Digital Sources and Cables.”

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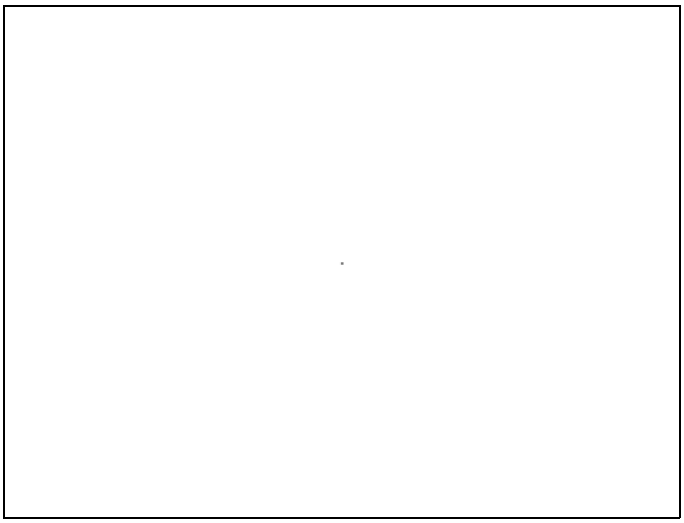
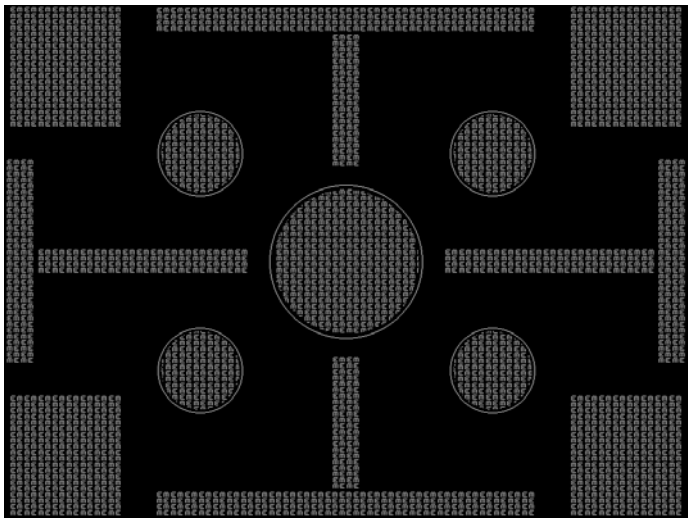
AnsiLght

Description The primary version displays a white background with a small black pixel in the center fills the active video area. A secondary version displays a black background with a small white pixel in the center.



Apple1

Description Special test image developed per customer specifications. A secondary version shows reverse (black characters on white background).



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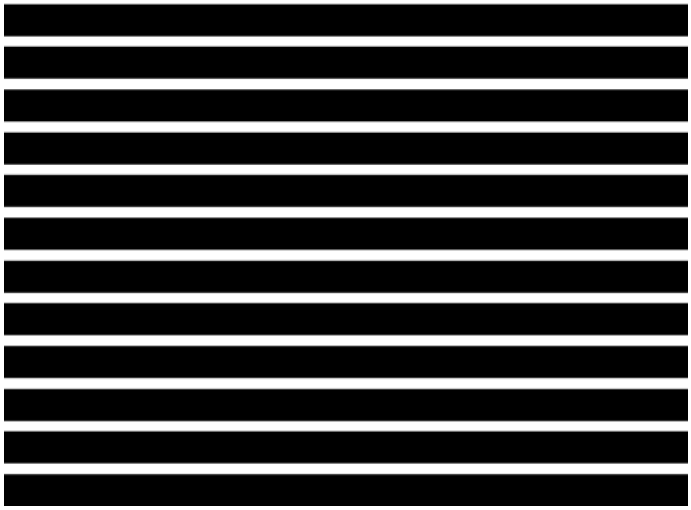
Audio LR, AudioLRf, AudioRAT, Audio_L, Audio_Lf, Audio_R, Audio_Rf

Description Used to configure HDMI audio output signal. The AudioLR is shown below. For more information, see “Testing HDMI audio” on page 155.

BarBlack

Description Special test image developed per customer specifications.

A secondary version shows reverse (black lines on white background).



BLU_EM, GRN_EM, RED_EM, WHT_EM, MEME1111, MEMESony, MESony_B, MESony_G, and MESony_R

Description In the primary version, the screen is filled with blue (BLU and B), green (GRN and G), red (R), or white (WHT, MEME1111, MEMEPlus, and MEMESony) EM character blocks on a black background. Only the white character has a secondary version. It is drawn with black characters on a white background.

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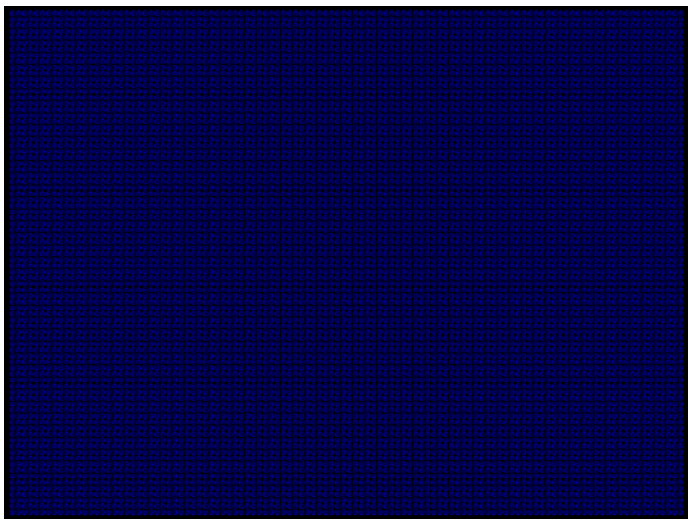
A bitmap of a single character block is shown here. The BLU_EM image is shown below.



Test Focus

Purpose This pattern is specified by some display manufacturers for checking and adjusting focus one color at a time.

BLU_EM+, GRN_EM+, RED_EM+, WHT_EM+, MEMEPlus, MEPlus_B, MEPlus_G, and MEPlus_R

Description In the primary version, the screen is filled with blue (BLU and B), green (GRN and G), red (R), or white (WHT and Sony) EM character blocks on a black background. Only the white character has a secondary version. It is drawn with black characters on a white background.

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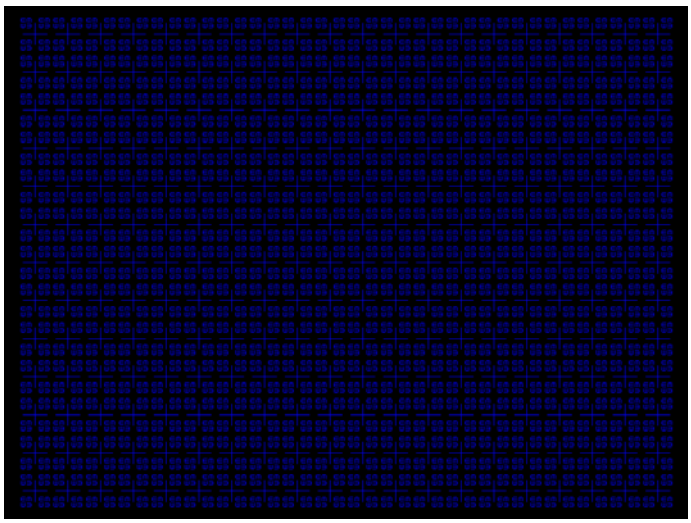
A bitmap of a single character block is shown here. The BLU_EM+ image is shown below.



Test Focus

Purpose This pattern is specified by one or more display manufacturers for checking and adjusting focus one color at a time.

BLU_PIC, GRAY_PIC, GRN_PIC, RED_PIC, WHT_PIC

Description A solid blue (BLU), gray, green (GRN), red, or white (WHT) box fills the active video area. Only the white fill has a secondary version. It can be changed to a black fill by pressing the **Step** key. The BLU_PIC image is shown below.

Test Purity adjustment

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Purpose To produce correct colors in a displayed image, the electron beams from each of the three (3) guns in the CRT should strike only their matching phosphors. A white image shows patches of various colors on a monitor with bad purity. The purity adjustment(s) should be performed before doing any brightness or color tests. In some cases, purity adjustments involve loosening and repositioning the yoke, in which case purity should be adjusted prior to doing any geometry tests.

Method The methods used for adjusting purity on a color monitor depend on the type of monitor and CRT (for example; Delta, In-Line or Single Gun). In most cases, the first step is to degauss the CRT.

Note: *For a Delta Gun CRT, turn on only the red output. A solid uniform field of red should appear. If the color is not uniform, adjust the yoke and the Purity Tabs assembly.*

If purity cannot be corrected to acceptable limits, the monitor may not have been properly degaussed or there may be a defect in the CRT or purity assembly.

Test Shadow mask warping

Purpose The purity characteristics of your CRT can change over time if you leave it on with a lot of video being displayed. This may be due to the CRT's electron beams striking its shadow mask with enough energy to cause the mask to heat. This internal heating may be enough to cause the shadow mask to warp and give bad purity.

Method Set the purity image to white and allow the monitor to run for a few minutes. Any mask warping shows up as a change in purity. You can use a color meter to measure the change. The BriteBox pattern may also be useful for measuring shadow mask warping.

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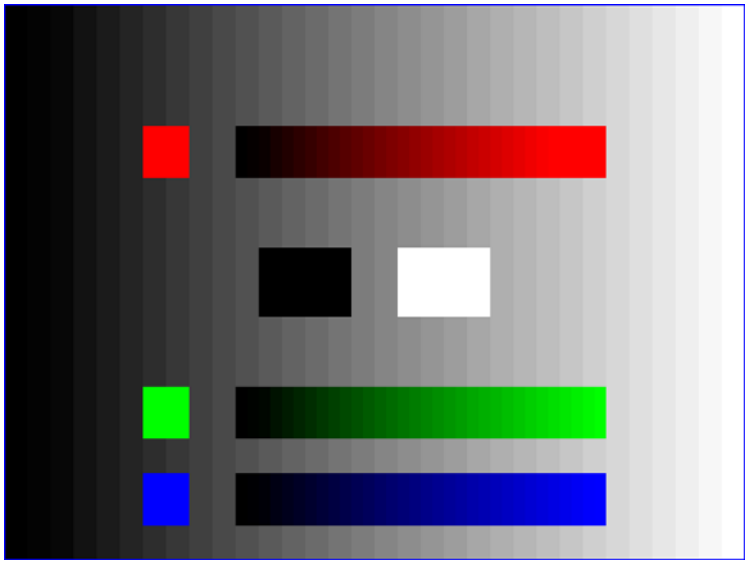
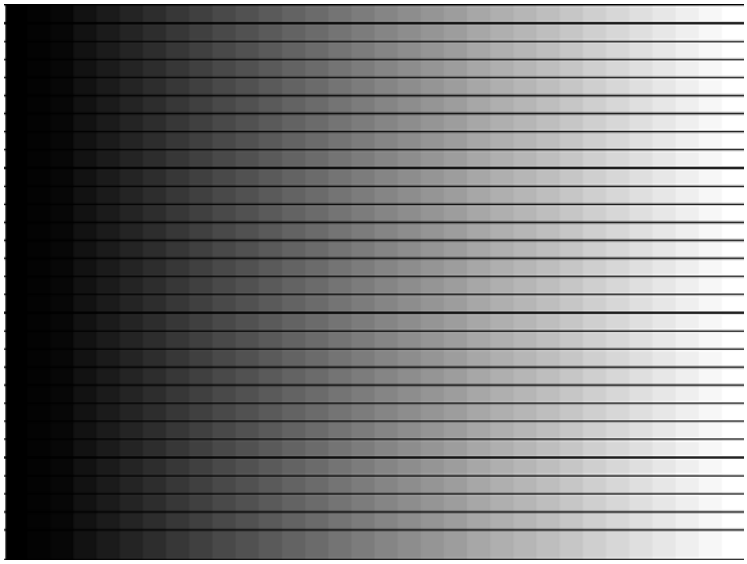
Bosch

Description Special test image developed per customer specifications. This image has 6 versions.





Box_50mm, Box_64mm, Box100mm, Box150mm, Box200mm, Box250mm

Description The primary version has a solid white box in the center of the active video. Depending on the image selected, the box is sized by square millimeters. If there is room, information on the current format appears below and to the left of the box. This shows the number of active pixels and lines as well as the horizontal and vertical scan rates. A forward slash (*/*) after the number of active lines indicates the format is interlaced.

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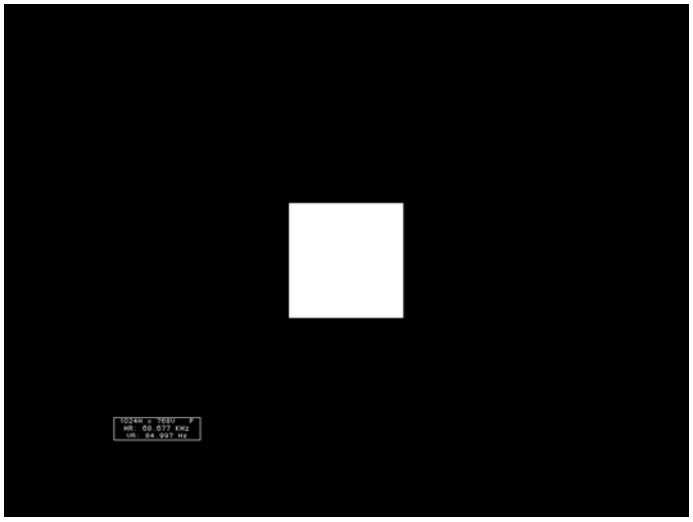
Note: *The box will be the correct size only if the correct physical active video size is set in the format.*

The Box_50mm image is shown below. The secondary version draws a black box and black text on a white background.



Test Brightness control adjustment

Purpose The wrong brightness setting may cause other tests such as Contrast, Focus, and Beam Size to be invalid. An accurate brightness setting helps give repeatable measurements throughout other tests.

Method Center your light meter probe within the center square and adjust the monitor's brightness control to obtain the required light meter reading.

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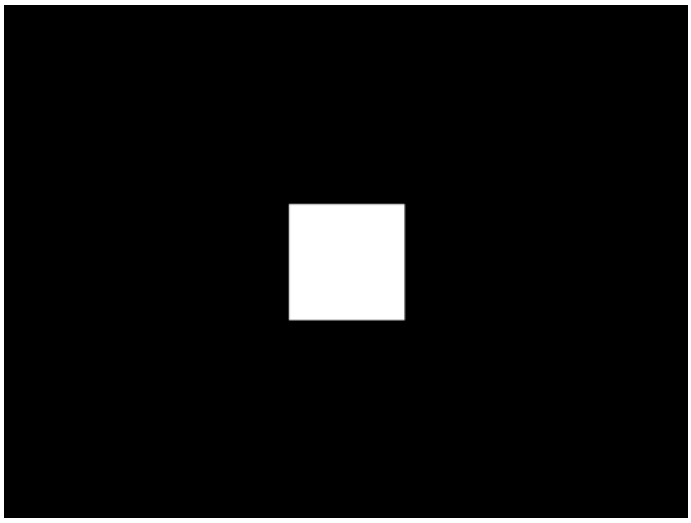
BriteBox

Description The primary version has a single white box in the center of active video. The box size is controlled by the MSIZ system parameter. The secondary version adds four boxes in the corners of active video.



Test Brightness control adjustment

Purpose The wrong brightness setting may cause other tests such as Contrast, Focus, and Beam Size to be invalid. An accurate brightness setting helps give repeatable measurements throughout other tests.

Method Center your light meter probe within the center square and adjust the monitor's brightness control to obtain the required light meter reading.

Test Brightness uniformity

Purpose The light output of most picture tubes varies slightly when measured across the CRT face. This test can be used to verify that the light output variation is within your specification limits.

Method Select the inverted version and perform the Brightness Control Adjustment test on the center box. Then, center the light meter probe in each of the corner squares and note the reading you get for each square. The deviation between each of the corner readings and the center reading should be within your specification limits.

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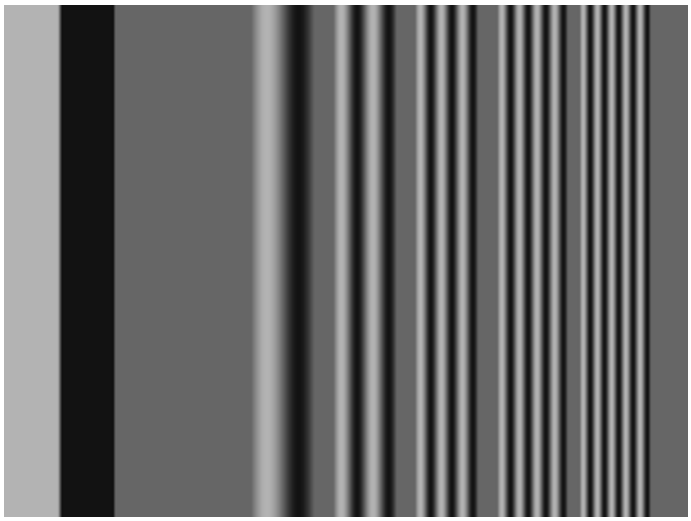
Burst (TV formats only)

Description

The left side starts with reference white (+100 IRE) and black (+7.5 IRE) levels. This is followed by six bursts of sine waves. Each burst is at a different frequency, forming vertical lines of various widths. The frequencies, going from left to right, are 0.5, 1, 2, 3, 3.58, and 4.43 MHz.



Test

Frequency response

Method

When viewed on a TV screen, the peak intensities of all of the bursts should match the white reference level. The darkest portions between the peaks should match the black reference level.

The image can also be used with a TV waveform analyzer to check the frequency response of a video system. One scan line of the image, as it would appear on a waveform analyzer, is shown at the top of the next page . High frequency roll-off (loss) would show up as a decrease in the peak-to-peak swings on the right side of the waveform. Low frequency roll-off would show up as a decrease in the peak-to-peak swings on the left side of the waveform.

Some waveform analyzers can be set to detect and display the amplitude of the peaks. A typical amplitude waveform for a good system is shown at the bottom of the next page.

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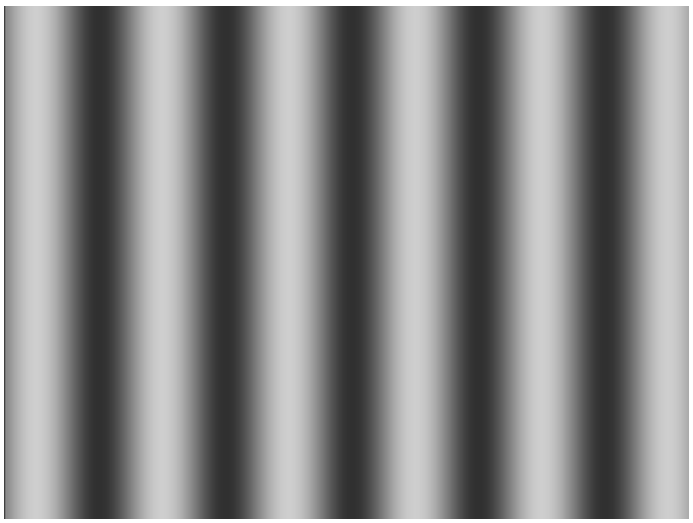
BurstTCE

Description Fills screen with a 0.5 MHz frequency. This can be increased in 0.5 MHz increments by pressing the **Step** key, and then turning the **Image** knob.



CardBMP

Description Selecting this image loads the BMP image stored on the PCMCIA card inserted into the generator. For more information, see “Downloading bitmap images from a PCMCIA card” on page 78.

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Check511

Description — Consists of five small boxes in the corners and at the center of the active video. The boxes are on a black background. Each box consists of alternating black and white pixels that form a very fine checkerboard. The secondary version inverts the image, creating a white background. The colors of the individual pixels in the boxes also are inverted.

Test — Verify monitor resolution

Purpose — The resolution of your monitor should meet or exceed the design specifications.

Method — First adjust the brightness, contrast, and focus to their correct settings. You should be able to see individual and distinct pixels in each of the boxes. Failure to see distinct pixels may indicate you have a defective video amplifier, focus correction circuit, or picture tube.

Note: *If multi-colored areas appear on a mask-type color picture tube, you may have a problem with convergence or you may be exceeding the resolution of the picture tube.*

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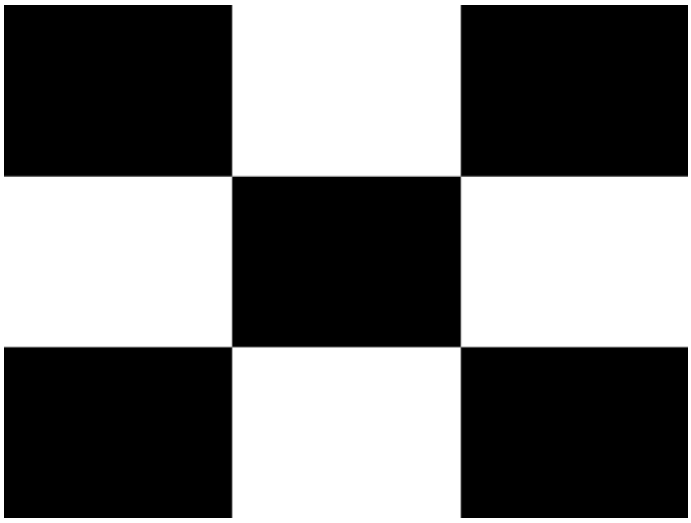
CheckBy3

Description The active video area is equally divided into a 3x3 checkerboard of black and white boxes. The primary version has four white boxes as shown in the image below. The secondary version has five white boxes (reverse).



Test Contrast ratio

Purpose The pattern is based on a proposed ANSI method of measuring the contrast ratio of video projection systems.

Method Using a light meter probe, measure and record the light-level reading (in foot lamberts) in the center of each of the black and white boxes. The contrast ratio is expressed as the average of all of the white readings divided by the average of all of the black readings.

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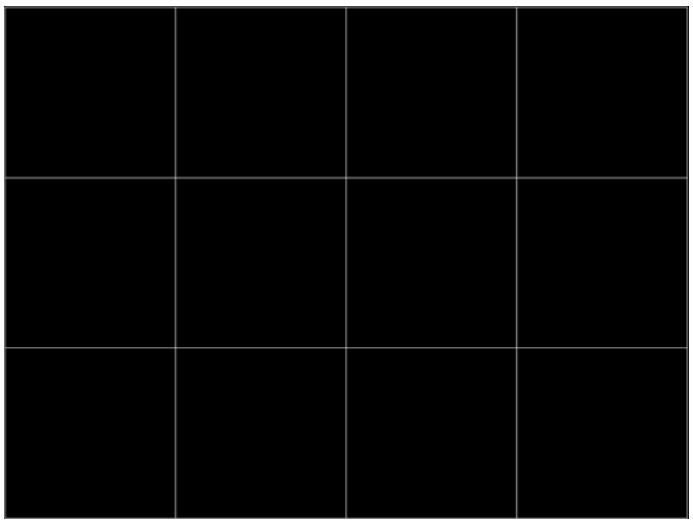
Check_02

Description Primary version is shown below. The secondary version has reverse (black lines on white background).



Check_11

Description In the primary version, the active video area is filled with alternating black and white pixels that form a very fine checkerboard, as shown below. The secondary version inverts the colors in the image. The inverted image looks almost the same as the non-inverted version.

Test Verify monitor resolution

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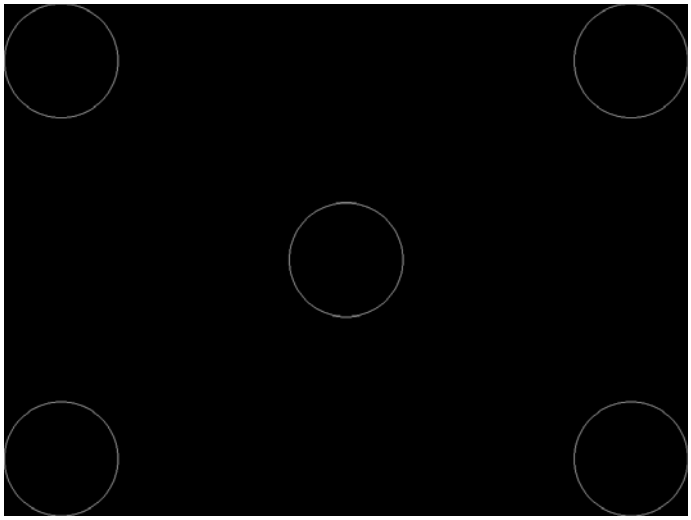
Purpose The resolution of your monitor should meet or exceed the design specifications.

Method Adjust the brightness, contrast, and focus to their correct settings first. You should be able to see individual and distinct pixels in each of the boxes. Failure to see distinct pixels may indicate you have a defective video amplifier, focus correction circuit, or picture tube.

Note: *If multi-colored areas appear on a mask-type color picture tube, you may have a problem with convergence, or you may be exceeding the resolution of the picture tube.*

CirclesL

Description Special test image developed per customer specifications. In the primary version (shown below), the image consists of five large white circles on a black background. The circles are positioned in the center and in the corners of the active video area. The secondary version inverts the image to black circles on a white background.



Purpose This pattern is specified by some monitor manufacturers for checking and adjusting video scan size, linearity, and over scanning.

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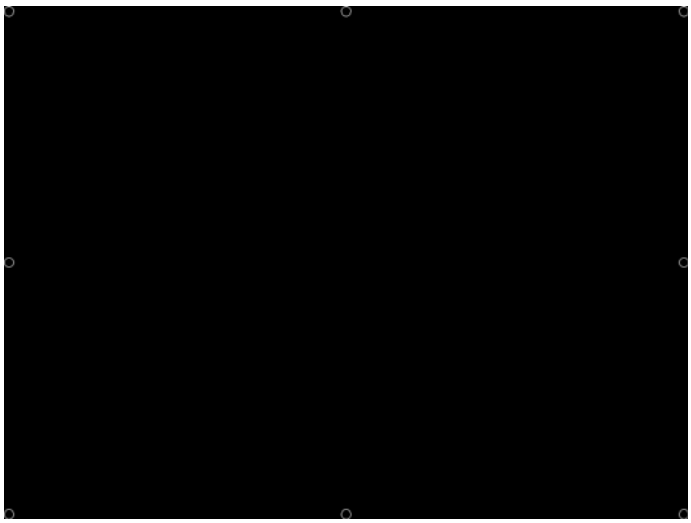
CirclesS

Description — Special test image developed per customer specifications. In the primary version (shown below), the image consists of eight small white circles on a black background. The circles are positioned in the corners of the active video area and centered on each edge of the active video area. The secondary version inverts the image to black circles on a white background.



Purpose — This pattern is specified by some monitor manufacturers for checking and adjusting video scan size, linearity, and over scanning.

ColorBar

Description — The primary version (shown below) has 16 full-height vertical color bars. The secondary version splits the field into a top and bottom half. The bars in the bottom half of the screen are in reverse order.

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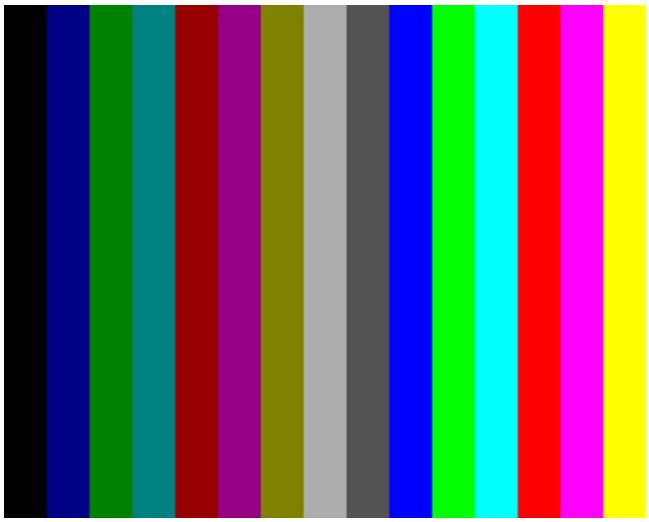
Note: *When outputting digital video, 33% Gray changes to 50% Gray, and 67% Gray becomes either Black or some gray level depending on how the display interprets the video information.*



Test Verify that all video channels are functional

Purpose To verify that none of the video channels are bad or connected incorrectly.

Method Compare the sequence of color bars with the table. Missing bars may indicate a dead or unconnected channel. The transition between the bars should be sharp and distinct. Each bar should also be uniform in color and intensity across its entire width. Non-uniformity may indicate problems with the response of the video amplifiers. If all the bars are present but in the wrong order, one or more inputs may be swapped.

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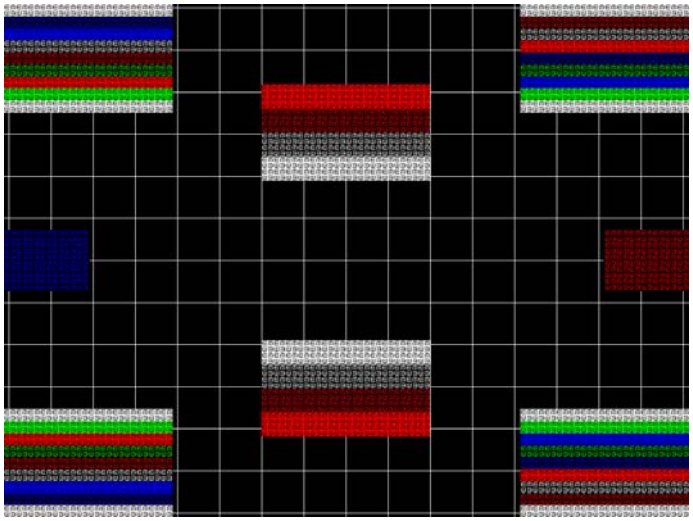
ComFocus

Description Special test image developed per customer specifications.



Cubes

Description This is an animated image consisting of one small multicolored cube orbiting around a larger multicolored cube. Each cube also is spinning on its own axis. The default text string is *Quantum Data*, which can be changed using commands. The primary version (shown below) has a black background and a thick green border. The secondary version uses a white background.

Purpose Can be used for show demonstrations with your own text.

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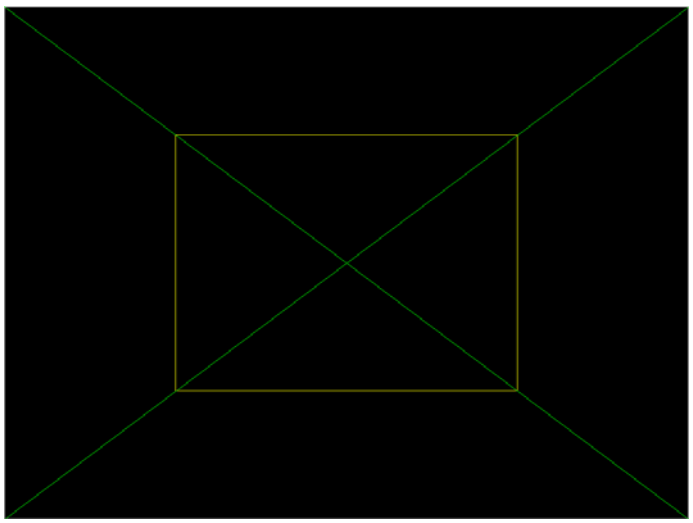
Custom

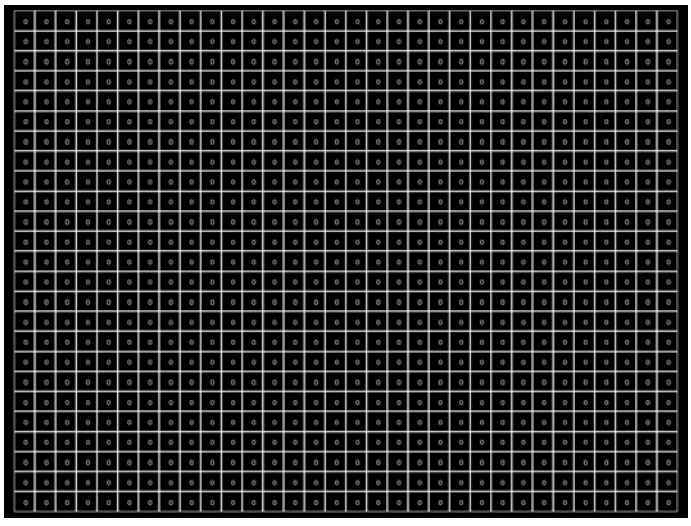
Description This image has a white border around the active video, a centered smaller yellow box, and green diagonals.



Purpose This image is an example of some of the available drawing primitives. It is not intended to be an image suitable for testing or adjusting a display. Rather, it can be used as a starting point for developing a custom image of your own.

DeltaErr

Description Use with analyzer to test for flickering pixels in a static image. For more information, see “Measuring pixel errors” on page 123.



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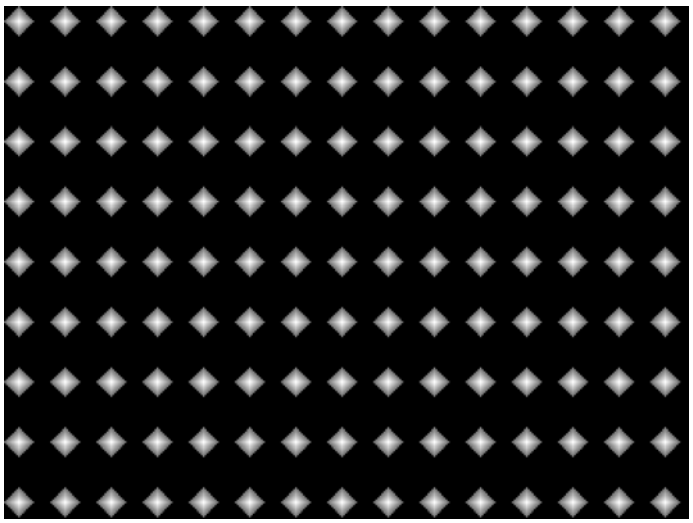
Diamond1

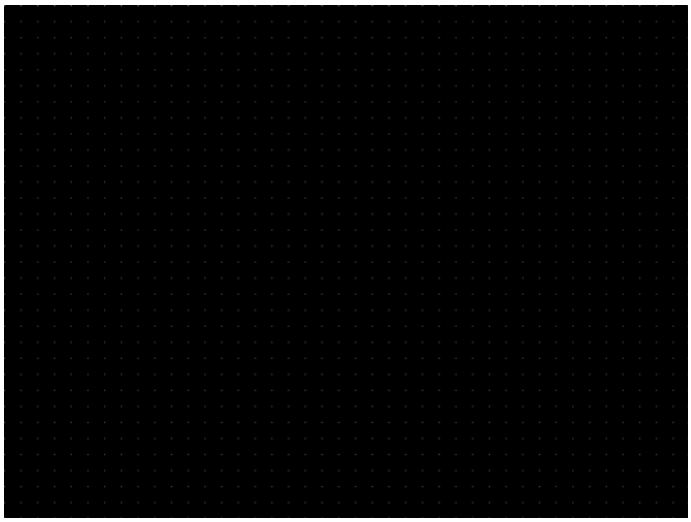
Description Special test image developed per customer specifications.



Dot1606, Dot1610, Dot1612, Dot1615, Dot1812, Dot1815, Dot2016

Description The primary version has white pixel dots on a black background. The secondary version has black pixel dots on a white background.

The primary version of the Dot2016 image is shown below.



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Dot_10, Dot_12, Dot_24

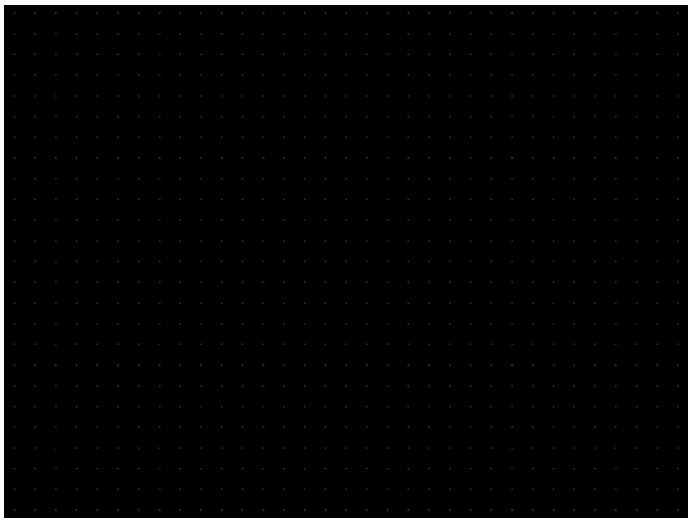
Description

The active video area is filled with multiple rows of white, single pixel dots. The dots define the corners of what would appear to be square boxes if all connecting pixels were lit. The number of rows of boxes and the number of boxes per row depends on which version of the image is selected and the screen aspect ratio of the currently-loaded format. The number in the image's name refers to the number of boxes that will be formed along the minor axis for most aspect ratios. The generator calculates the ratio and then finds the closest match from the following table.

Aspect Ratio		**Dot_10**		**Dot_12**		**Dot_24**	
W : H	Decimal	Number of Rows	Boxes per Row	Number of Rows	Boxes per Row	Number of Rows	Boxes per Row
16 : 9	1.777 É	10	16	10	16	18	32
5 : 3	1.666 É	10	16	10	16	18	30
4 : 3	1.333 É	10	14	12	16	24	32
1 : 1	1.000	10	10	12	12	24	24
3 : 4	0.750	14	10	16	12	32	24

The primary version has white pixel dots on a black background. A secondary version has black pixel dots on a white background.

The primary version of the Dot_24 image is shown below.



Purpose

To accurately produce an image on a color monitor, the three electron beams in the CRT must meet (converge) at the same location at the same time. Small dots displayed on a misconverged monitor appear as a group of multi-colored dots.

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Method The convergence adjustments of most color monitors fall into two main categories. The first set of adjustments, usually called Static Convergence, aligns the three beams in the center of the display. This method involves turning on all three guns and adjusting the various magnets on the convergence assembly to produce all white dots in the center of the display. The convergence assembly is located on the neck of the CRT. Different monitors and CRT types may each require their own magnet-adjustment sequence.

After the center of the display is properly converged, the outer areas are adjusted by using the monitor's Dynamic Convergence controls. The number of controls, the area of the screen they affect, and their adjustment procedure depends on the monitor under test.

Test Focus adjustments

Purpose An out-of-focus monitor displays fuzzy pixels which, in turn, result in poorly formed and hard-to-read characters.

Method On monitors with a single (static) focus adjustment, adjust the control for the best average focus over the entire screen. The focus at certain locations should be within specified limits.

Some monitors have a static and one or more dynamic focus controls. The sequence for adjusting them and the areas of the screen they affect depend on the monitor under test.

DV_Swing

Description This image is only available with DVI and HDMI. The DV_Swing image is used to temporally change the digital video swing (DVSS format parameter) between 90 and 1620 mVp-p of the HDMI and DVI digital output for the active format. This image displays the current video swing value over a graduated (ramp) background. This image is supported by HDMI boards (revision F or later), and DVI boards with FPGA F1 or later.

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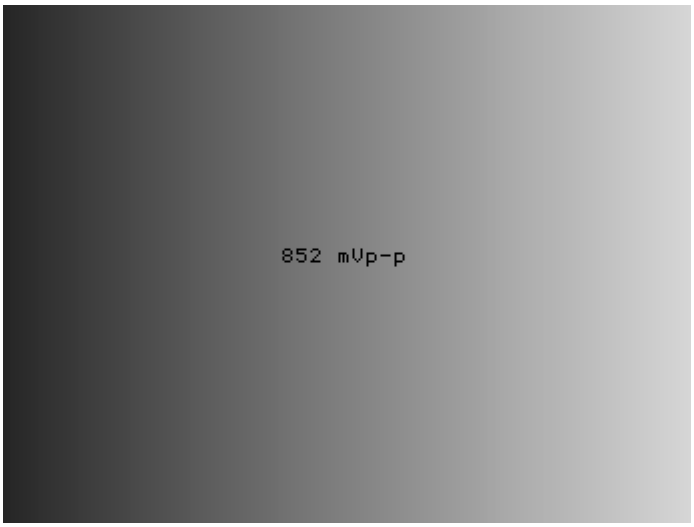
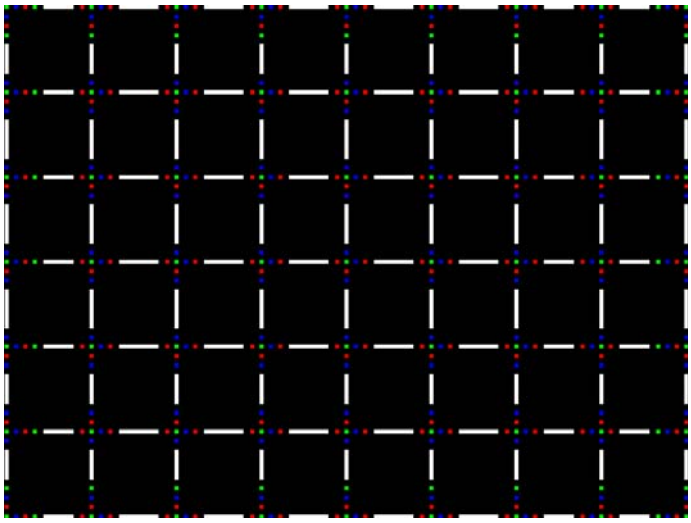
Note: *The DVSC command can be used to set the swing value between 150 and 1500 mVp-p.*



Method To adjust the swing in 4 mV increments, press the Step key, then turn the Image knob. Press the Step key again to reset the digital swing value to the default value, which is 1000 mVp-p for all formats.

Dyna

Description This image has multiple versions that display different sizes of the same pattern. Version 0 is shown below.



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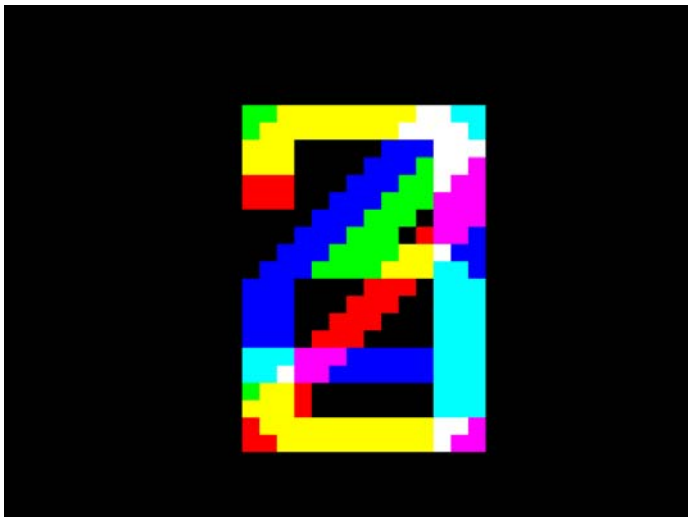
EdidData

Description Displays EDID from the display connected with the generator. For more information, see page 171.

Elbit

Description Special test image developed per customer specifications. This image has 19 versions.



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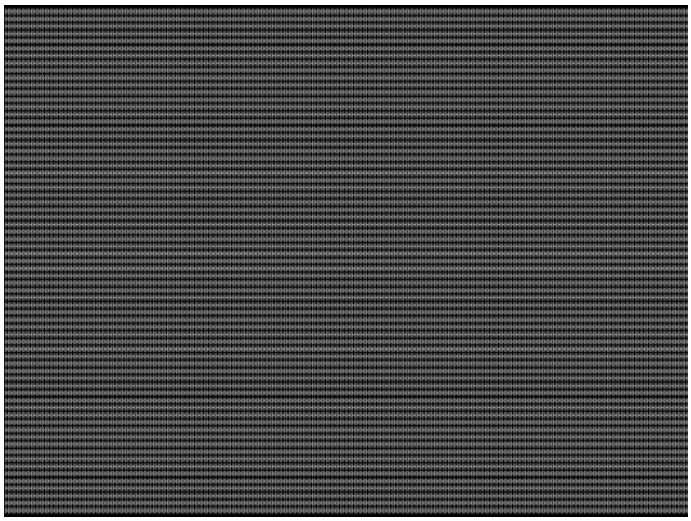
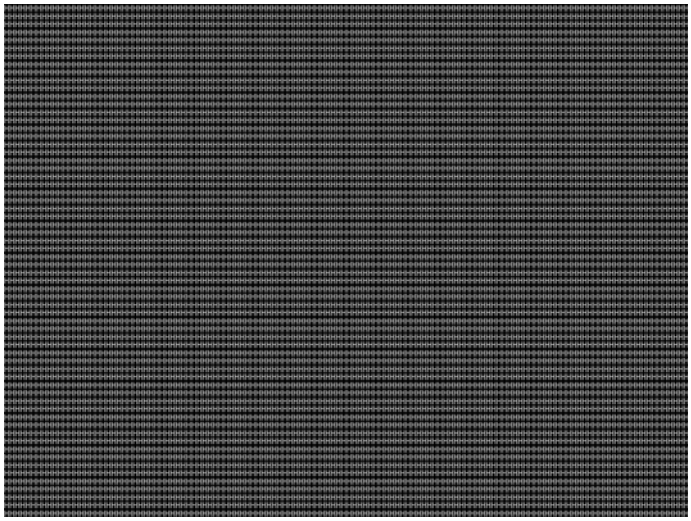
EMITest1, EMITest2, EMITest3, EMITest4, EMITest5

Description Special test images used for electro-magnetic interference (EMI) testing of displays. The entire active video area is filled with an “H” character. The primary versions of these images draw white characters on a black background. The secondary versions draw black characters on a white background. The EMITest1 image is shown below.



The EMITest2 image is the same as EMITest1, but with the bottom row of characters constantly drawn left-to-right and then cleared.

The EMITest3 image is the same as EMITest1, but with a larger version of the “H” character.



The EMITest4 image is the same as EMITest3, but with the bottom row of characters constantly drawn left-to-right and then cleared.

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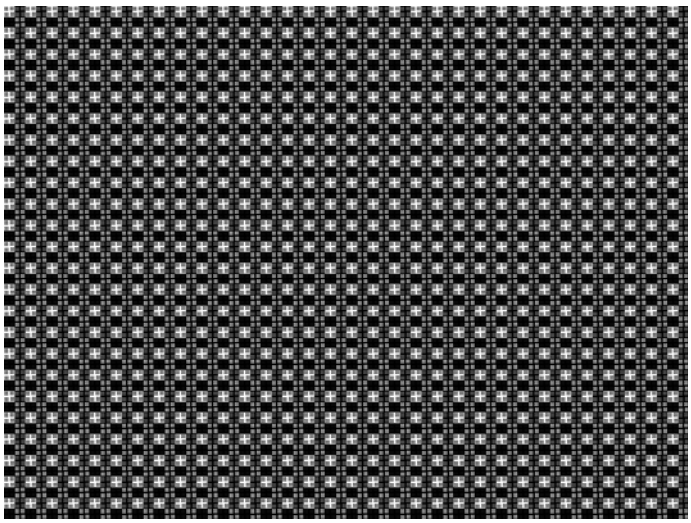
The EMITest5 image is shown below.



FlashGry

Description This image flashes a flat gray image at a high-frequency rate.

The image flashed on the display is shown below.

FlashRGB

Description This image flashes RGB colors at a high frequency rate.

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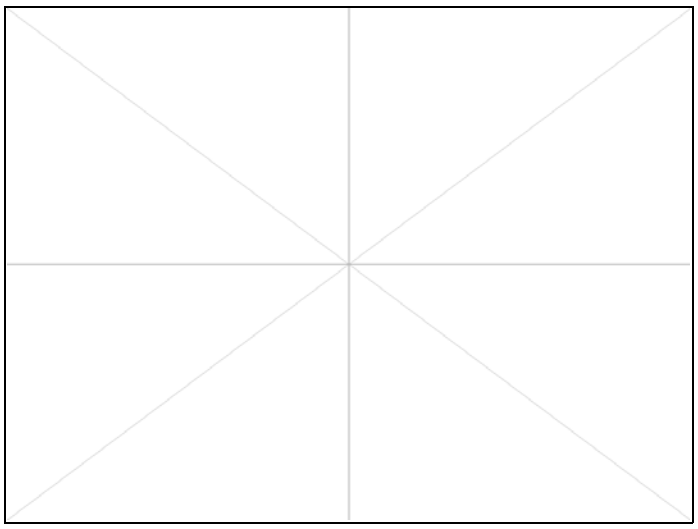
The image used as a background on the display is shown below.



Flat, Flat07, Flat13, Flat20, Flat27, Flat33, Flat40, Flat47, Flat53, Flat60, Flat67, Flat73, Flat80, Flat87, Flat93, FlatGray, Flat_01, Flat_02, Flat_03, Flat_04, Flat_05, Flat_06, Flat_07, Flat_08, Flat_09, Flat_10, Flat_11, Flat_12, Flat_13, Flat_14, Flat_15, Flat_16

Description The entire active video area is filled with a shade of gray. Each image displays a different shade of gray. The FlatGray image is shown below.

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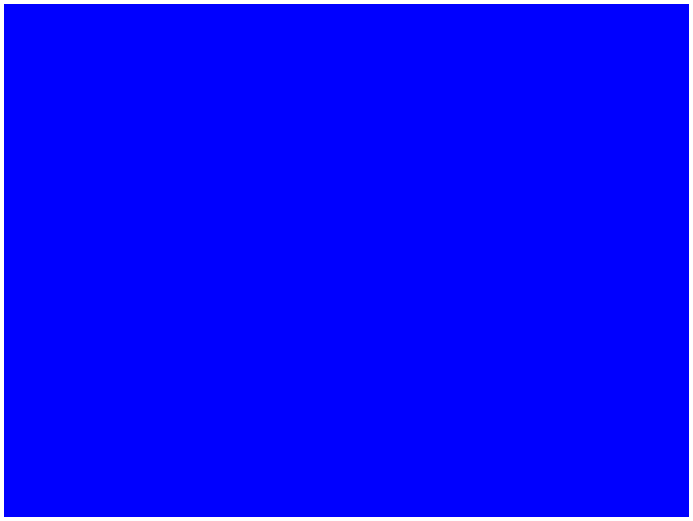
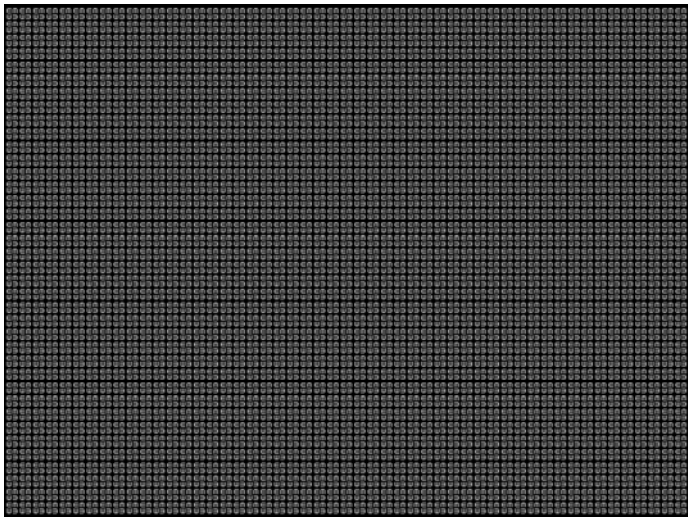
Flat_B, Flat_G, Flat_R

Description The screen is filled with blue (B), green (G) or red (R). The Flat_B image is shown below.



Focus20

Description Primary version shown below. The secondary version has black characters on a white background.



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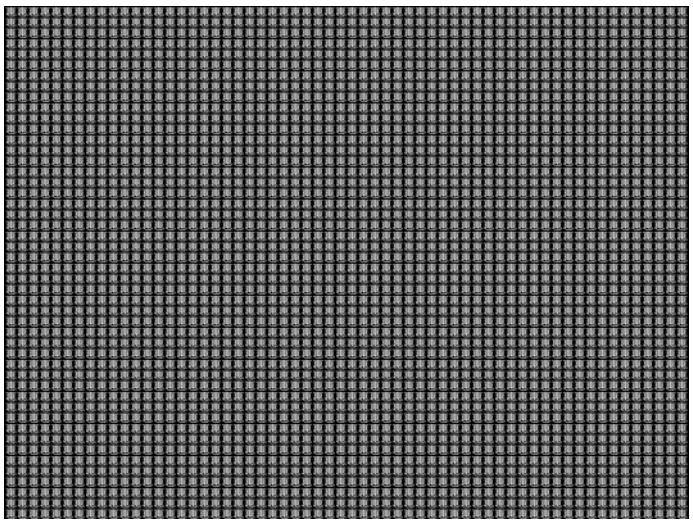
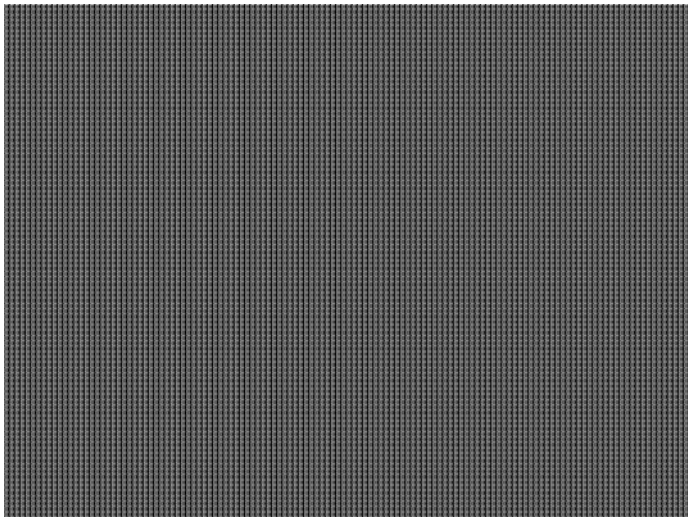
FocusC14

Description Primary version shown below.The secondary version has black characters on a white background.



FocusCCx

Description Primary version shown below. The secondary version has black characters on a white background.



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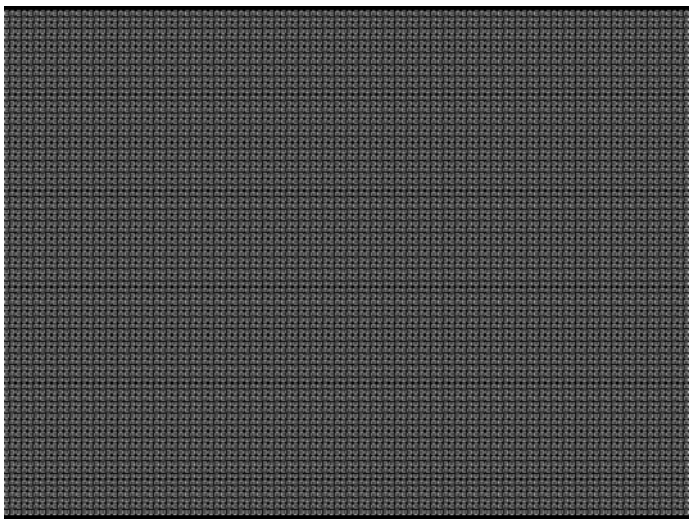
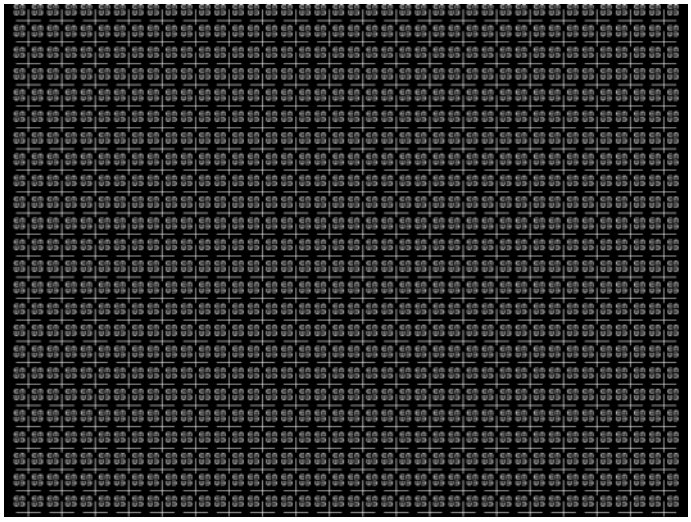
FocusEM

Description Primary version shown below. The secondary version has black characters on a white background.



FocusEMP

Description Primary version shown below. The secondary version has black characters on a white background.



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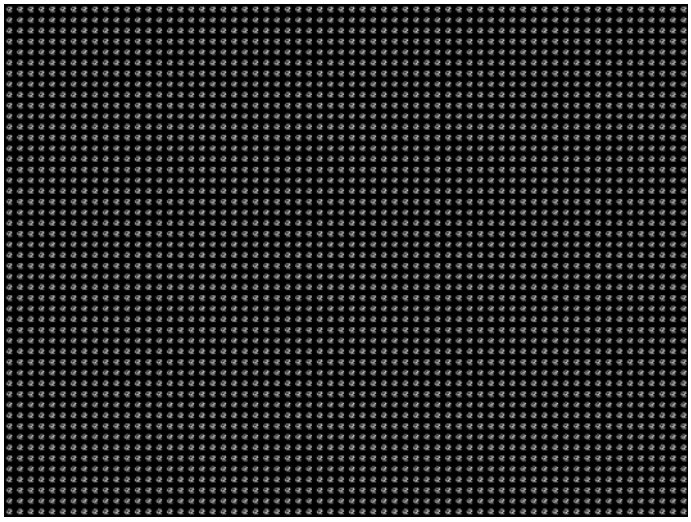
FocusM00 - FocusM15

Description The FocusM00 image is shown below.

Focus_@6, Focus_@7, Focus_@8, Focus_@9

Description In the primary versions, the screen is filled with white “@” characters on a black background. The secondary versions are drawn with black characters on a white background. The primary version of the Focus_@6 image is shown below.



Test Focus adjustments

Purpose An out-of-focus monitor displays fuzzy graphic images and poorly formed, hard-to-read text characters.

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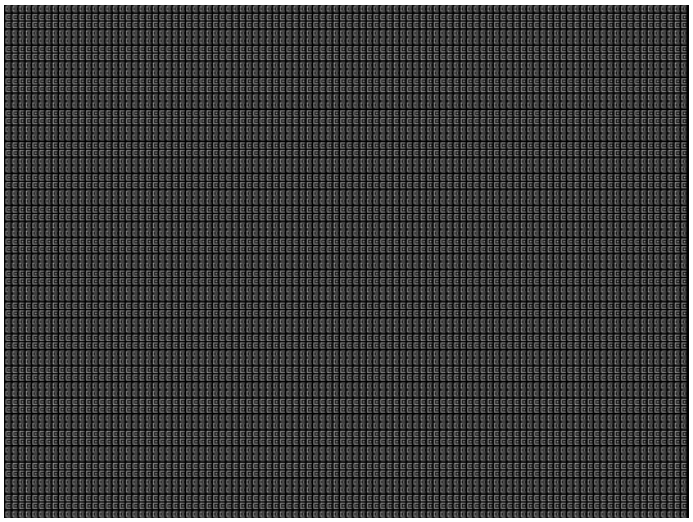
Method On monitors with a single (static) focus adjustment, adjust the control for the best average focus over the entire screen. The focus at certain locations of the screen should be within specified limits.

Some monitors have a static and one or more dynamic focus controls. The sequence for adjusting them and the areas of the screen that they affect depend on the monitor under test.

Focus_Cx

Description In the primary version (shown below), the screen is filled with white Cx characters on a black background. The secondary version is drawn with black characters on a white background.



Test Focus adjustments

Purpose An out-of-focus monitor displays fuzzy graphic images and poorly formed, hard-to-read text characters.

Method On monitors with a single (static) focus adjustment, adjust the control for the best average focus over the entire screen. The focus at certain locations of the screen should be within specified limits.

Some monitors have a static and one or more dynamic focus controls. The sequence for adjusting them and the areas of the screen that they affect depend on the monitor under test.

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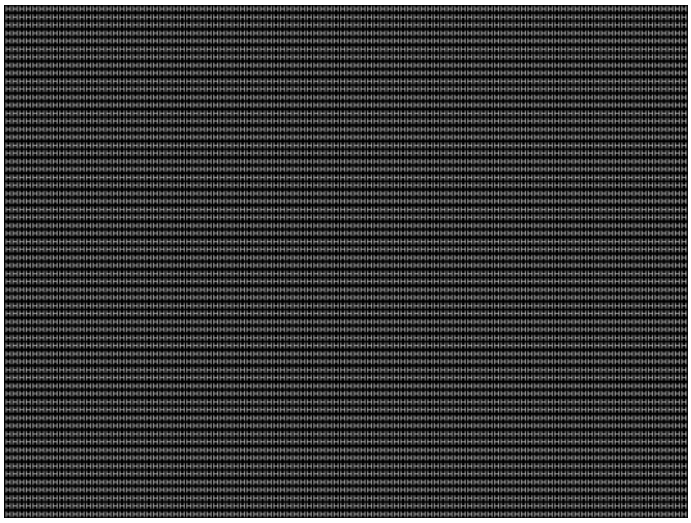
Focus_H

Description In the primary version (shown below), the screen is filled with white H characters on a black background. The secondary version is drawn with black characters on a white background.



Test Focus adjustments)

Purpose An out-of-focus monitor displays fuzzy graphic images and poorly formed, hard-to-read text characters.

Method On monitors with a single (static) focus adjustment, adjust the control for the best average focus over the entire screen. The focus at certain locations of the screen should be within specified limits.

Some monitors have a static and one or more dynamic focus controls. The sequence for adjusting them and the areas of the screen that they affect depend on the monitor under test.

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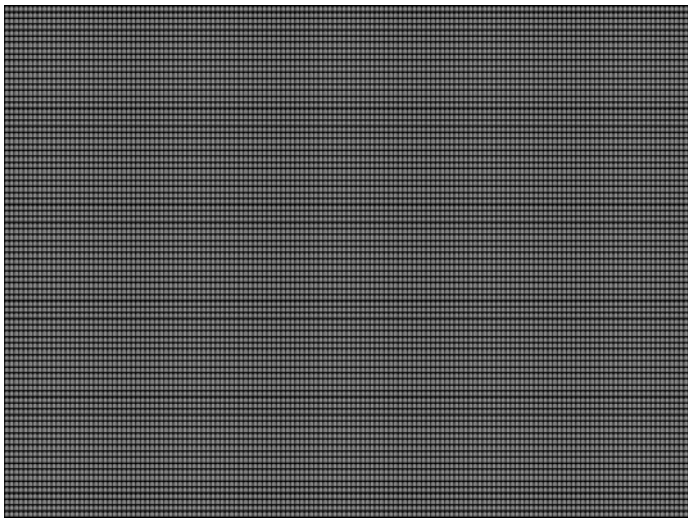
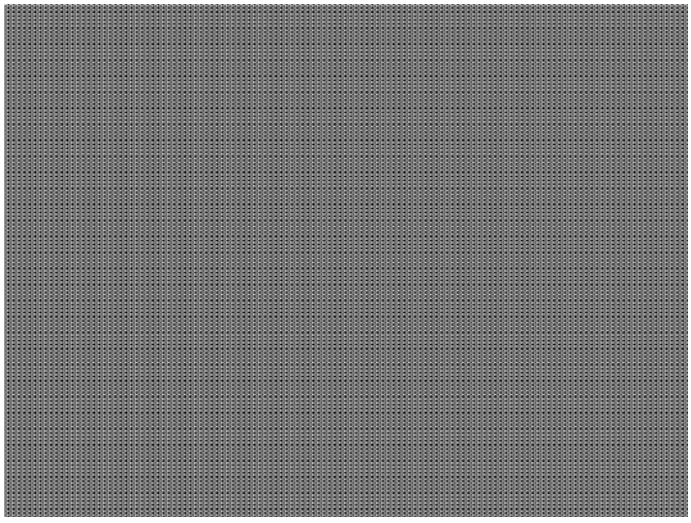
Focus_MM

Description In the primary version (shown below), the screen is filled with white M characters on a black background. The secondary version is drawn with black characters on a white background.



Focus_Oo

Description In the primary version (shown below), the screen is filled with white Oo characters on a black background. The secondary version is drawn with black characters on a white background.



Test Focus adjustments

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Purpose An out-of-focus monitor displays fuzzy graphic images and poorly formed, hard-to-read text characters.

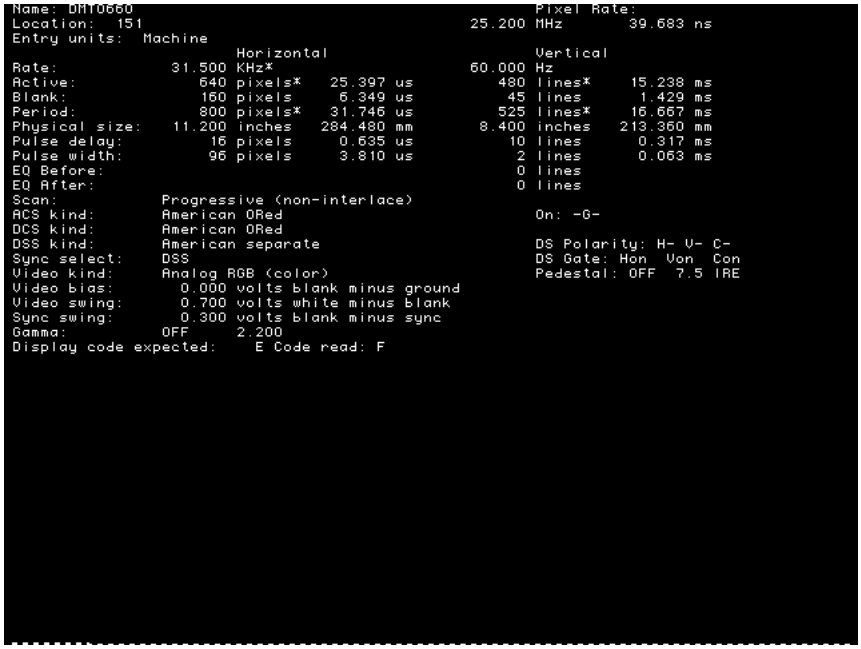
Method On monitors with a single (static) focus adjustment, adjust the control for the best average focus over the entire screen. The focus at certain locations of the screen should be within specified limits.

Some monitors have a static and one or more dynamic focus controls. The sequence for adjusting them and the areas of the screen that they affect depend on the monitor under test.

Format

Description A listing of the data contained in any format. The primary image lists the settings of the format driving the display. The secondary image can be used to list the contents of any stored format (via the Location field).

This pattern works best at display resolutions of at least 640 pixel by 480 lines.


Name: DMT0660
Location: 151
Entry units: Machine
Pixel Rate:
25.200 MHz 39.683 ns
Horizontal
Vertical
Rate: 31.500 KHz* 60.000 Hz
Active: 640 pixels* 25.397 us 480 lines* 15.238 ms
Blank: 160 pixels 6.349 us 45 lines 1.429 ms
Period: 800 pixels* 31.746 us 525 lines* 16.667 ms
Physical size: 11.200 inches 284.480 mm 8.400 inches 213.360 mm
Pulse delay: 16 pixels 0.635 us 10 lines 0.317 ms
Pulse width: 96 pixels 3.810 us 2 lines 0.063 ms
EQ Before: 0 lines
EQ After: 0 lines
Scan: Progressive (non-interlace)
ACS kind: American ORed
On: -G-
DCS kind: American ORed
DSS kind: American separate
DS Polarity: H- V- C-
Sync select: DSS
DS Gate: Hon Von Con
Video kind: Analog RGB (color)
Pedestal: OFF 7.5 IRE
Video bias: 0.000 volts blank minus ground
Video swing: 0.700 volts white minus blank
Sync swing: 0.300 volts blank minus sync
Gamma: OFF 2.200
Display code expected: E Code read: F

FormatRx

Description Used by analzyer to view timing parameters measured from external signal. For more information, see “Measuring timing of video signal” on page 114.

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GenOps

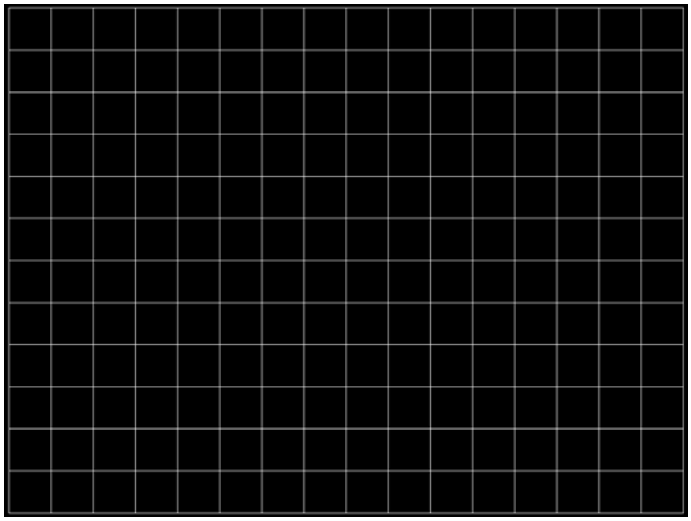
Description Provides key sequences and status of special operating modes. For more information, see “Special operating modes” on page 18.

GenStats

Description Provides detailed information about the generator. For more information, see “Displaying system information” on page 44.

Geom_1 - Geom_5

Description The primary version of the Geom_1 image is shown below. Secondary version is drawn with black lines on a white background.



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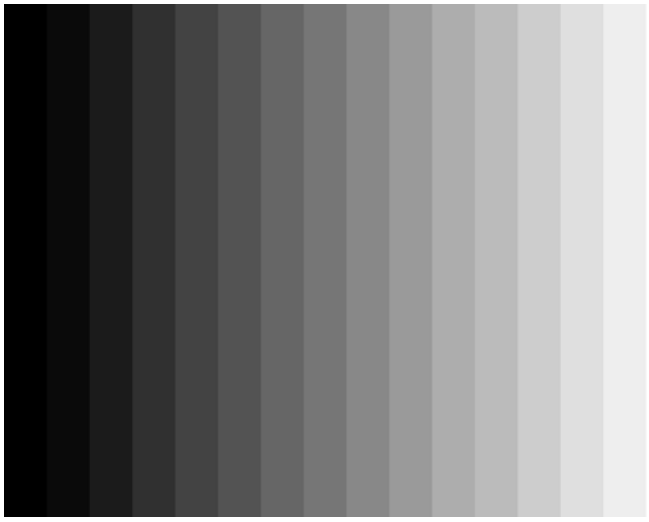
Gray25, Gray40

Description The Gray25 image is shown below.

GrayBar

Description The primary version (shown below) has 16 full-height vertical graybars. The intensity of the bars is shown below. The secondary version splits the field into a top and bottom half. The bars in the bottom half of the screen are in reverse order.



Test Video color tracking (color monitors)

Purpose To verify that a color monitor accurately reproduces colors at all intensities.

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Method Perform the Brightness Control Adjustment and Brightness Uniformity tests first.

Changes in brightness from bar to bar should be uniform. All of the bars should appear as an untinted gray at all levels.

Test Video gain linearity (monochrome monitors)

Purpose To check the video linearity (grayscale modulation)

Method Perform the Brightness Control Adjustment and Brightness Uniformity tests first.

Changes in brightness from bar to bar should be visible and uniform.

GrayL1, GrayL3

Description The GrayL1 image is shown below.

Grays5, Grays9, Grays11, Grays16, Grays32, Grays64

Description These images have the designated number of full-height vertical graybars.

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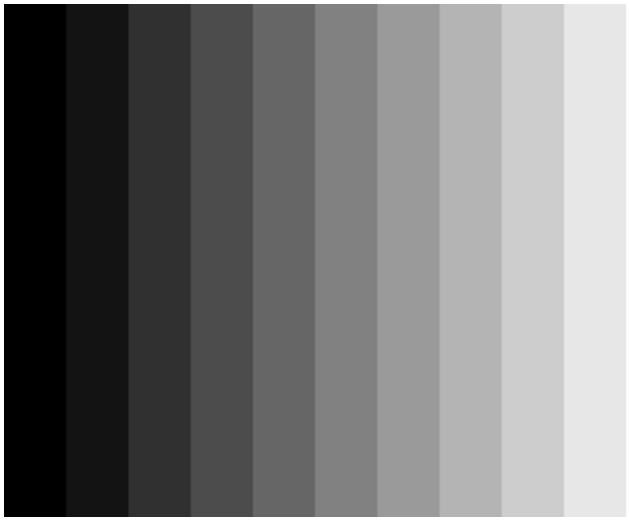
The Grays11 image is shown below.



GraysAll

Description Contains 256 grayscale versions, from 0 (full black) to 255 (full white).

Grill_11, Grill_15, Grill_22, Grill_33, Grill_44

Description The entire active video area is filled with alternating black and white stripes. The stripes are drawn at different resolutions. Each of the stripes is four (4) pixels wide in the Grill_44 image and three (3) pixels wide in the Grill_33 image. Each of the stripes is two (2) pixels wide in the Grill_22 image and one (1) pixel wide in the Grill_11 image.

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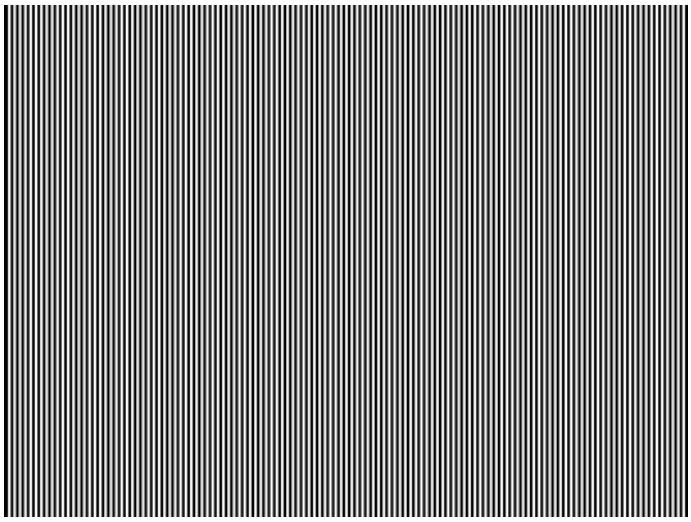
The primary versions draw vertical stripes. The secondary versions draw horizontal stripes. The primary version of the Grill_44 image is shown below.



Test Verify monitor resolution

Purpose The resolution of your monitor should meet or exceed the design specifications.

Method First adjust the brightness, contrast, and focus to their correct settings. You should be able to see individual and distinct stripes in all areas of the display at all four resolutions. Failure to see distinct lines at the highest resolution (Grill_11) may indicate you have a defective video amplifier or picture tube.

Note: *If multi-colored lines appear on a mask-type color picture tube, you may have a problem with convergence or you may be exceeding the resolution of the picture tube.*

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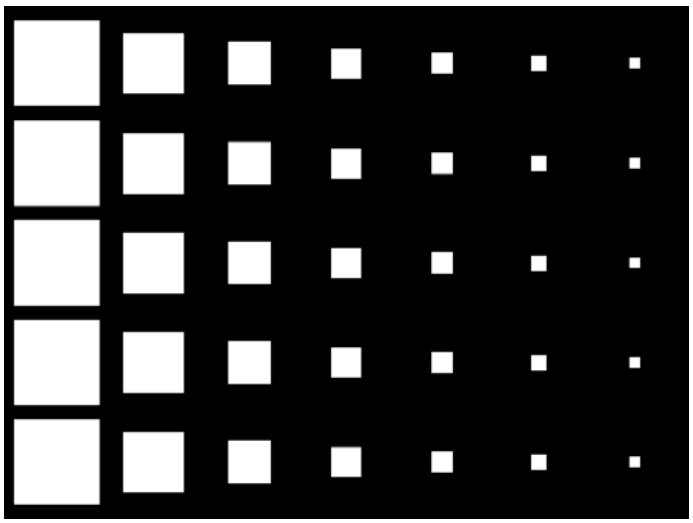
HalfArea

Description Primary version shown below. Secondary version is drawn with black boxes and white background.



HalfClk

Description

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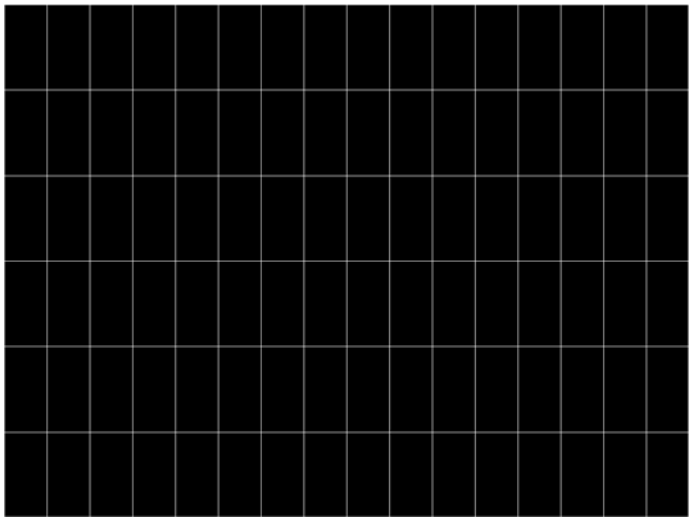
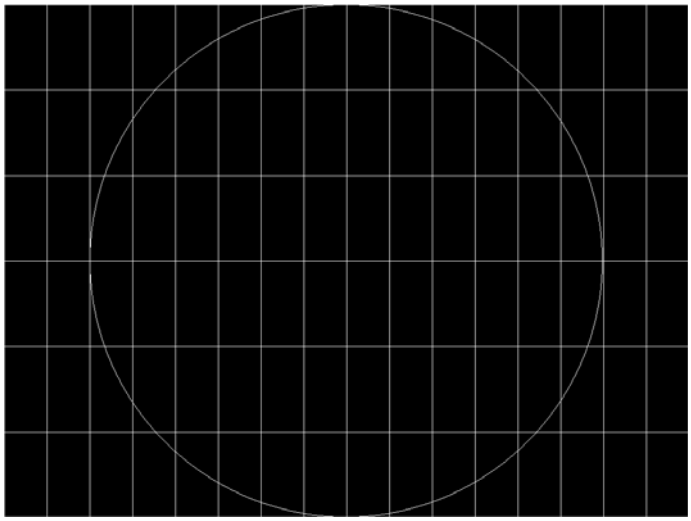
Hat1606, Hat1610, Hat1612, Hat1615

Description Primary version of Hat1606 is shown below. Secondary version is inversed.



Hat1606A, Hat1610A, Hat1612A, Hat1615A

Description Primary version of Hat1606A is shown below. Secondary version is inversed.



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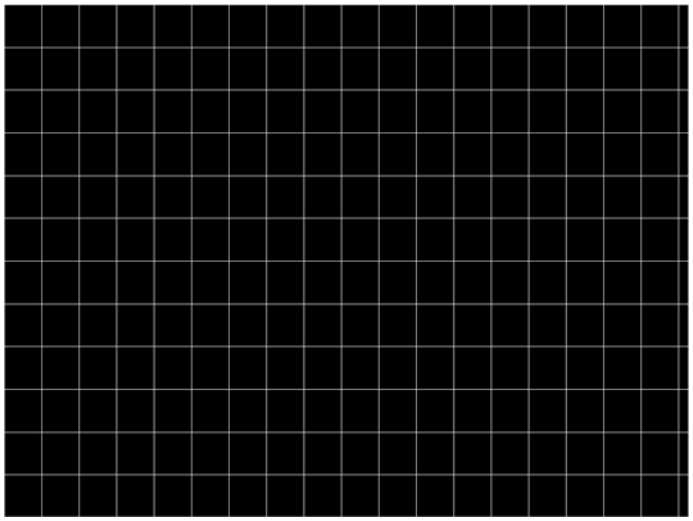
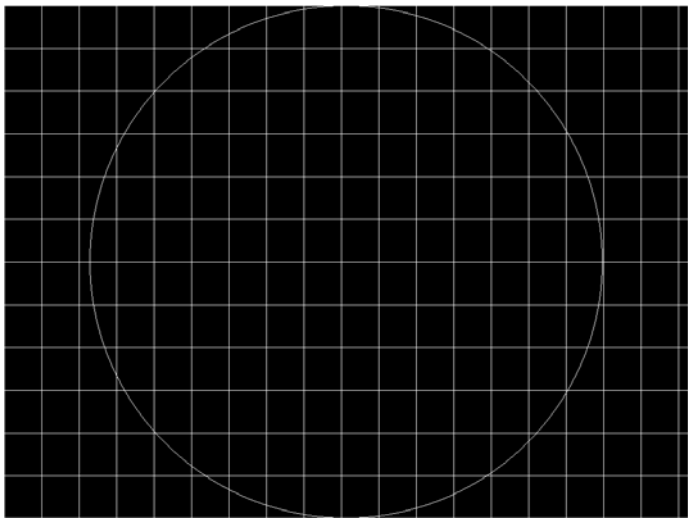
Hat1812, Hat1815

Description Primary version of Hat1812 is shown below. Secondary version is inversed.



Hat1812A, Hat1815A

Description Primary version of Hat1812A is shown below. Secondary version is inversed.



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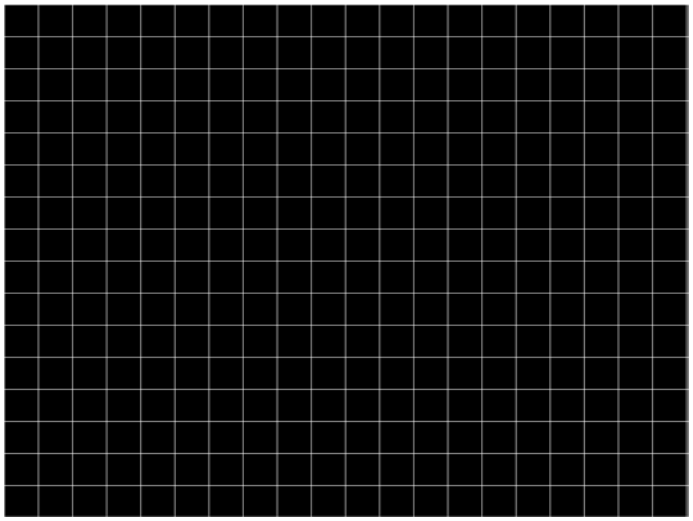
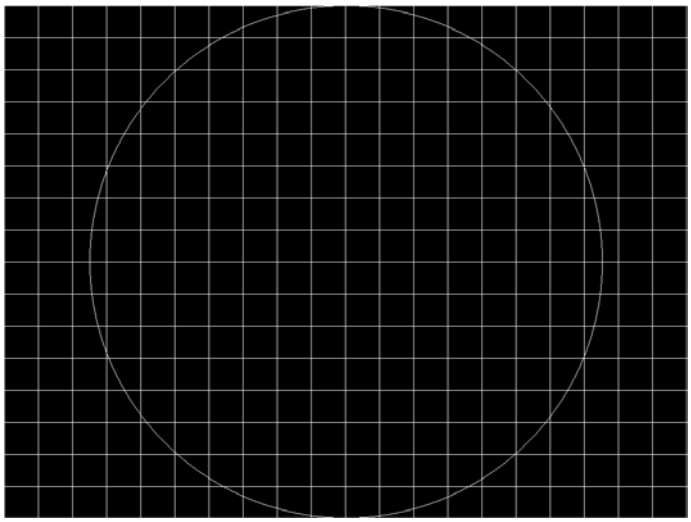
Hat2016

Description Primary version is shown below. Secondary version is inversed.



Hat2016A

Description Primary version is shown below. Secondary version is inversed.



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Hatch_6, Hatch_10i, Hatch_10o, Hatch_12i, Hatch_12o, Hatch_24i, Hatch_24o, Hatch_24s, Hatch_G, Hatch_M, GRN_HTCH, and MAGENTA

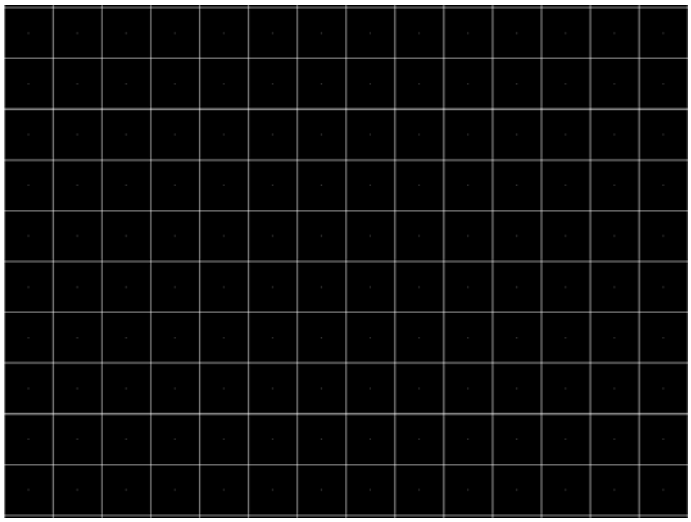
Description

The primary versions consist of a white, green (G and GRN), or magenta (M) crosshatch drawn on a black background. The lines form square boxes. A single pixel dot is located in the center of each crosshatch box. The number of boxes formed depends on the version of the image selected and the screen aspect ratio of the currently loaded format. The number in the image's name refers to the number of boxes that are formed along the minor axis for most aspect ratios. The generator calculates the ratio and then finds the closest match from the table on the next page. Version names indicate the drawing method, as follows:

- Versions ending in "i" draw from the inside (center) out. Any partial boxes are placed around the perimeter of the image.
- Versions ending in "o" draw from the outside in. Any partial boxes are placed along the centerlines of the image.
- Versions ending in "s" are the "i" version plus a 1-pixel thick border.

The secondary versions invert the images to black lines and dots on a white background. Hatch_G, Hatch_M, GRN_HTCH and Magenta do not have secondary versions.

The primary version of the Hatch_10i image is shown below.



Aspect Ratio		**Dot_10**		**Dot_12**		**Dot_24**	
W : H	Decimal	Boxes Vertically	Boxes Horizon-tally	Boxes Vertically	Boxes Horizon-tally	Boxes Vertically	Boxes Horizon-tally
16 : 9	1.777 É	10	16	10	16	18	32
5 : 3	1.666 É	10	16	10	16	18	30
4 : 3	1.333 É	10	14	12	16	24	32

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Aspect Ratio		Dot_10		Dot_12		Dot_24	
1 : 1	1.000	10	10	12	12	24	24
3 : 4	0.750	14	10	16	12	32	24

Test Convergence adjustment (color monitors only)

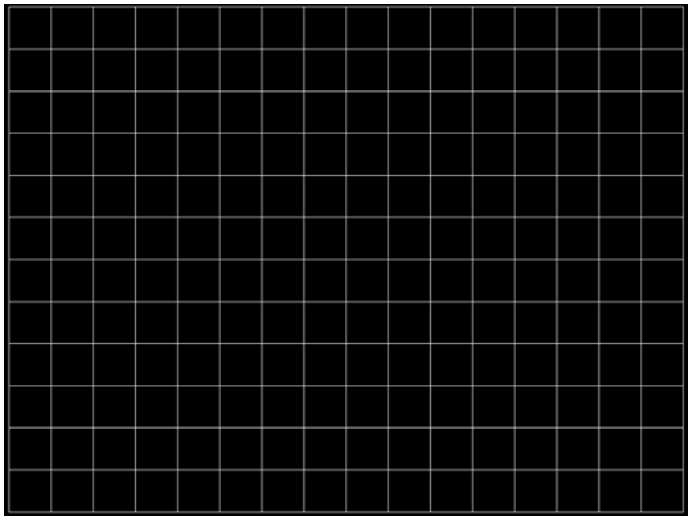
Purpose To accurately produce an image on a color monitor, the three electron beams in the CRT must meet (converge) at the same location at the same time. Lines displayed on a misconverged monitor appear as several multi-colored lines, and the transitions between different colored areas contain fringes of other colors.

Method The convergence adjustments of most color monitors fall into two main categories. The first set of adjustments, usually called Static Convergence, aligns the three beams in the center of the display. This method involves turning on all three guns and adjusting the various magnets on the convergence assembly to produce all white dots in the center of the display. The convergence assembly is located on the neck of the CRT. Different monitors and CRT types may each require their own magnet adjustment sequence.

After the center of the display is properly converged, the outer areas are adjusted by using the monitor's Dynamic Convergence controls. The number of controls, the area of the screen they affect, and their adjustment procedure depend on the monitor under test.

Hatch_16, Hatch_20

Description The primary version of the Hatch_16 image is shown below. The secondary versions draw black lines on a white background.



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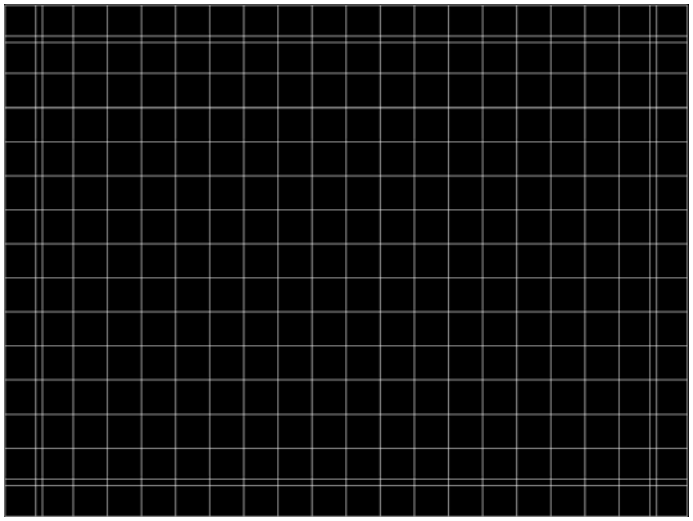
Hatch20

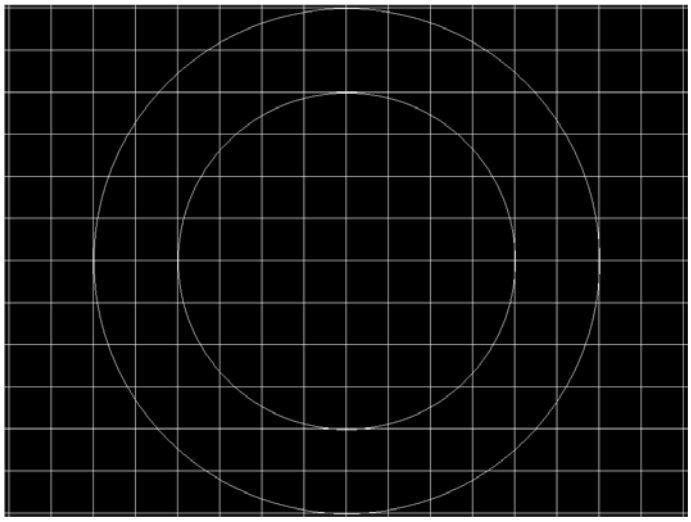
Description Primary version...The secondary version draws black lines on a white background.



Hatch4x3, Hatch5x4 and Hatch8x8

Description These are different versions of a crosshatch pattern that may be called for by some display manufacturers' test procedures. The primary version consists of white crosshatch and circles on a black background. The secondary version inverts the image to black lines on a white background.

The primary version of the Hatch4x3 image is shown below.



Purpose This is a general purpose test image that can be used to check and adjust video scan linearity and geometry and color convergence.

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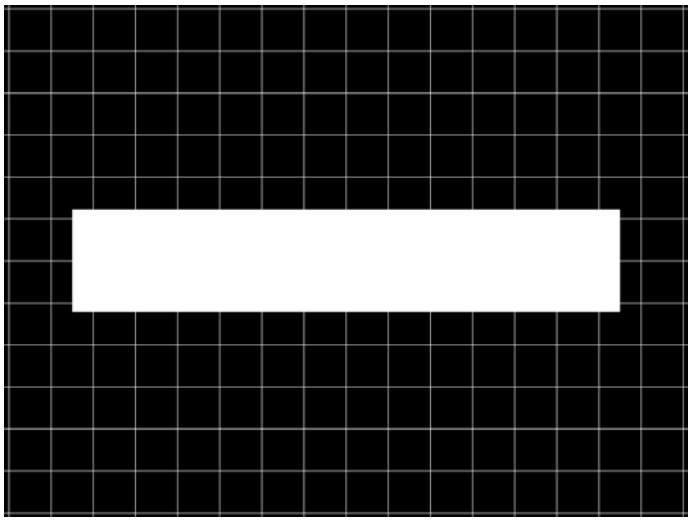
Hatch64W

Description This is a crosshatch pattern that may be called for by some manufacturers' test procedures. The primary version (shown below) consists of an 8x8 white crosshatch on a black background. A white rectangular patch is added in the center. The secondary version inverts the image to black lines and box on a white background.



Purpose

Method This is a general purpose test image that can be used to check and adjust video scan linearity and geometry, and color convergence. The large white rectangle also allows for checking a display's high voltage regulation. This is done by observing the vertical lines at the left and right edges of the image. They should be fairly straight and not pull in the area of the white rectangle.

HdcpA1B1, HdcpA1B2, HdcpA2B1, HdcpA2B2, HdcpProd

Description Used with HDCP feature. For more information, see Chapter 11, "Testing HDCP."

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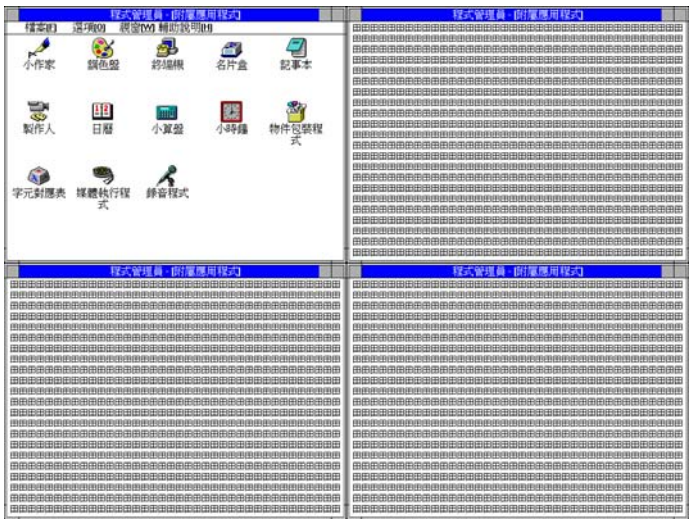
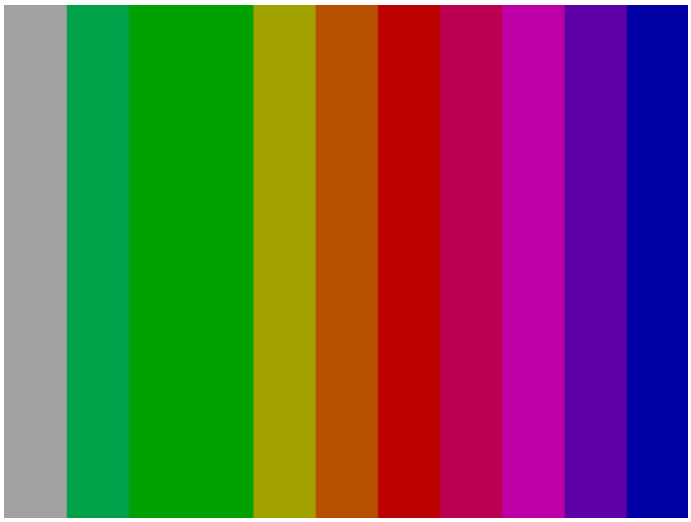
Hitachi1

Description Special test image developed per customer specifications. The image consists of a 2x2 cluster of Microsoft Windows® screen simulations using Japanese characters.



HSVnRGB

Description



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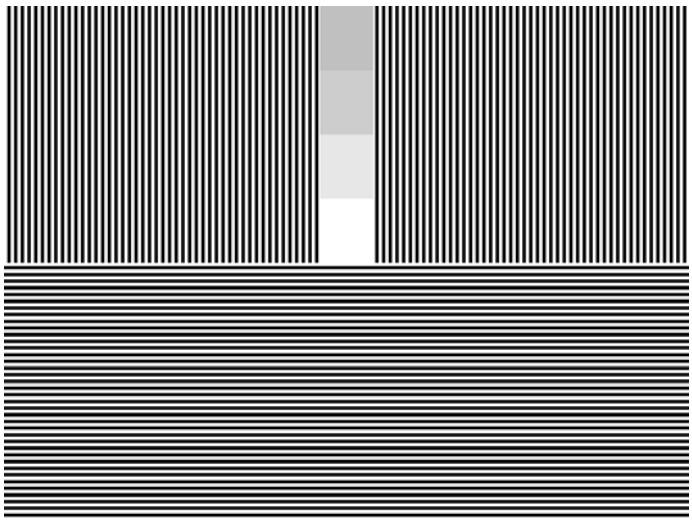
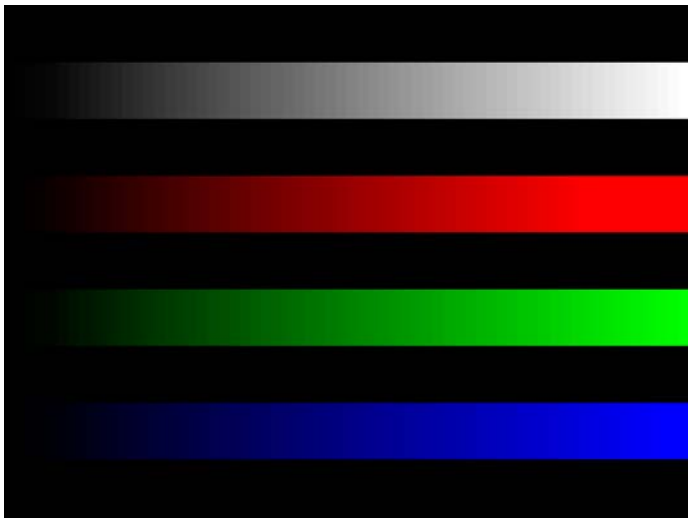
Imex1

Description



InFocus1

Description Special test image developed per customer specifications.



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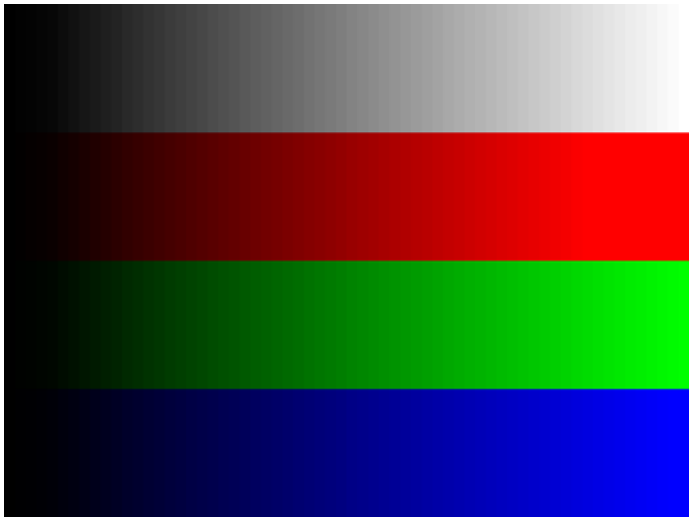
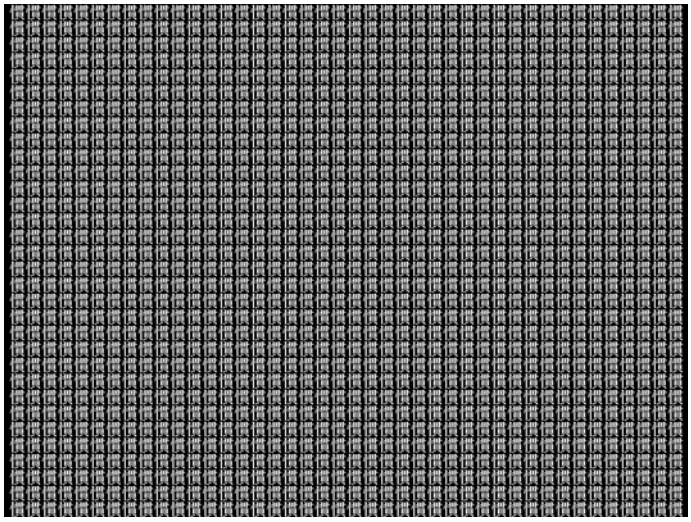
InFocus2

Description Special test image developed per customer specifications.



KanjiKAN

Description In the primary version (shown below), the screen is filled with white Japanese Kan characters on a black background. The secondary version is drawn with black characters on a white background.



Test Focus adjustments

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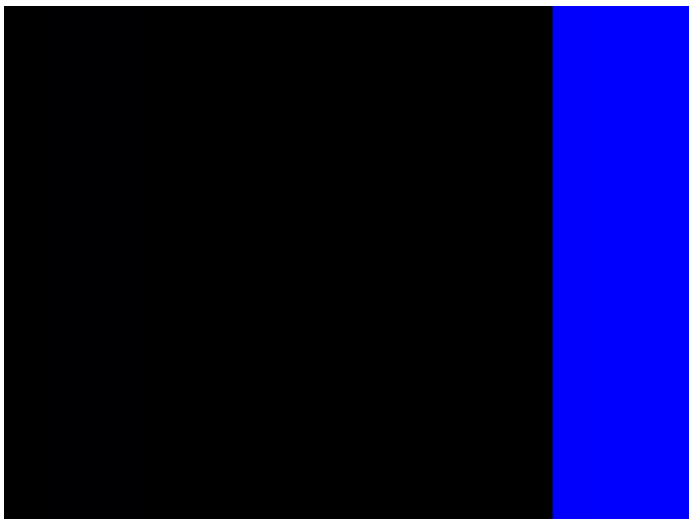
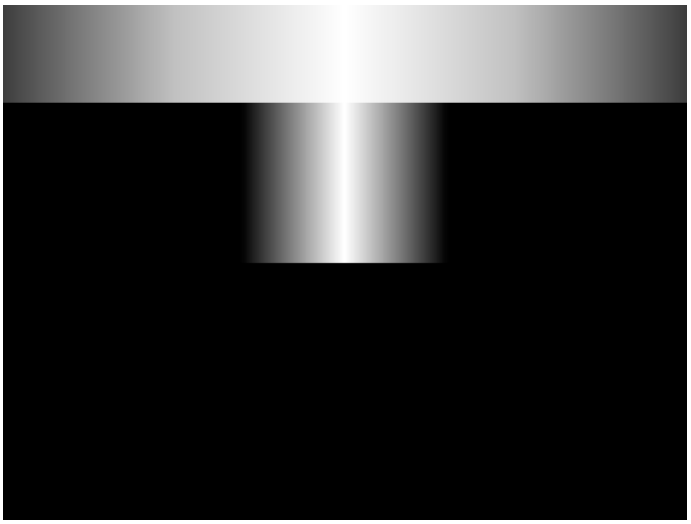
LGLCDTVB, LGLCDTVG, LGLCDTVR, LGLCDTVW

Description Special test image developed per customer specifications. Each image has three versions. The primary version of the LGLCDTVB image is shown below.



LGRamp

Description Special test image developed per customer specifications. The image provides a grayscale of two objects. The secondary version of the LGRamp image is shown below.



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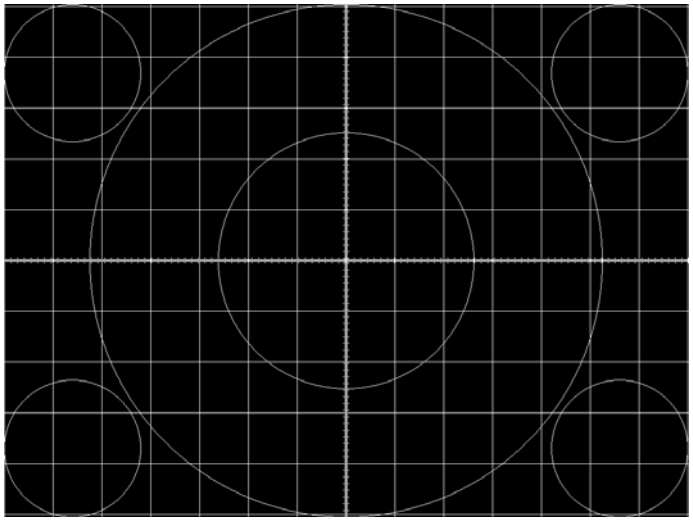
Linearty (Linearity)

Description

This image has three parts. The first part consists of six (6) white circles. A large circle is drawn in the center of the screen. Its diameter equals the lesser of the video height or width of the display. A smaller circle is drawn at half the diameter and concentric with the larger circle. A circle also is drawn in each of the corners of the screen. The diameter of the corner circles equals one-fifth of the display width.

The second part of the image consists of a white crosshatch. The number of boxes in the crosshatch depends on the physical size of the display.

The last part of the image consists of white tic marks on the horizontal and vertical center lines of the image. The marks are one pixel thick at every other pixel location. Every fifth mark is slightly longer. The color of the pattern can be changed with the individual video output controls.



Test

Linearity adjustment

Purpose

To present an undistorted display, the horizontal and vertical sweeps of the electron beam across the face of the CRT should be at uniform speeds. Any non-uniformity in the sweep causes portions of an image to stretch while other portions are compressed. Non-linearity in a monitor shows up in several ways. It may be present across the entire screen, in a large portion of the screen, or localized in a very small area.

Method

The circles in the image can be used to do a general adjustment of a monitor's linearity controls. Adjust the controls to form perfectly round circles. The crosshatch image can be used to measure linearity and to make finer control adjustments. All the full boxes in the crosshatch should be identical in size. Measure them with a ruler or a gauge made for the monitor under test. Any deviation should be within your specification limits. Use the tic

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marks and a ruler or gauge to measure linearity over a small portion of the display. Compare the number of tic marks per unit of measure with an adjacent or overlapping area.

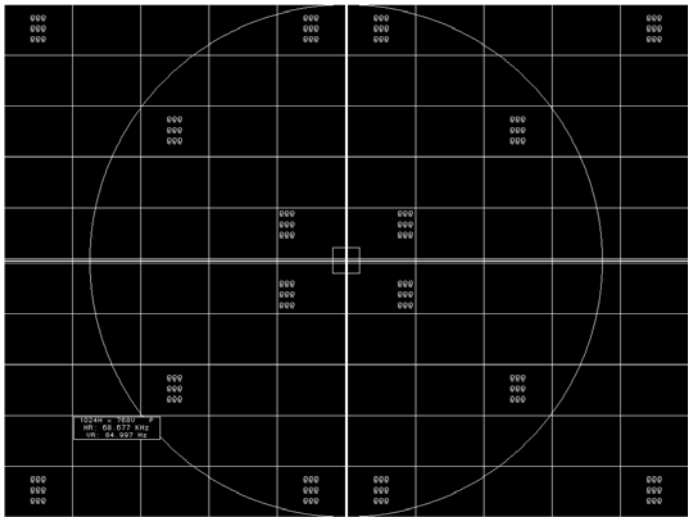
LinFocus

Description

This image has several parts. The first part consists of a large circle in the center of the screen. Its diameter equals the lesser of the video height or width of the display.

The second part is a 10x10 box crosshatch. The crosshatch is drawn in from the outside edges, with any extra pixels in the boxes placed along the vertical and horizontal axis. The vertical centerline is two pixels thick if the format has an even number of active pixels per line. The horizontal centerline is two pixels thick if the format has an even number of active lines per frame. A smaller box is added at the center of the image. The box is one-half the height and two-fifths the width of one of the crosshatch boxes. Current format data is shown in the lower left quadrant of the image. It shows the number of active pixels (H) and lines (V) as well as the vertical and horizontal scan rates.

The primary version (shown below) consists of a white pattern on a black background. The secondary version has a black pattern on a white background.



The image also includes blocks of focus-checking characters at various locations. The blocks are positioned inside the crosshatch boxes and are up to 3x3 characters in size. The size of the blocks is limited by the number of characters that can fit in one box.

Test

Linearity adjustment

Method

Please see the Linearity test image on “Linearty (Linearity)” on page 658 for information on measuring linearity.

Test

Focus adjustment

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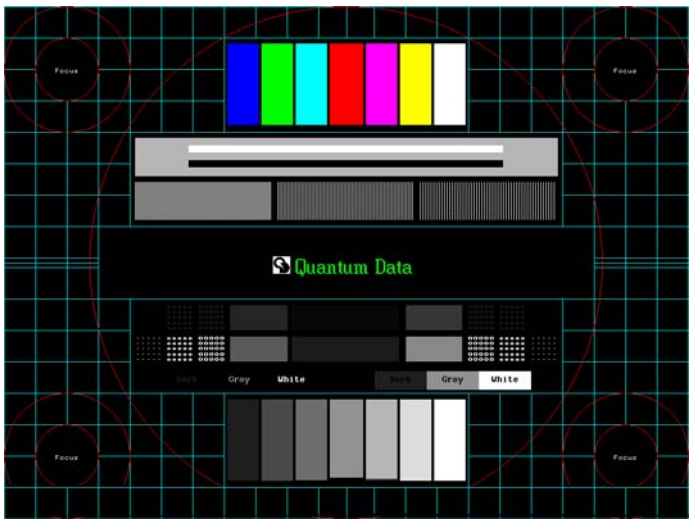
Purpose An out-of-focus monitor displays fuzzy graphic images and poorly formed, hard-to-read characters when text is displayed on the screen.

Method On monitors with a single (static) focus adjustment, adjust the control for the best average focus over the entire screen. The focus at certain locations of the screen should be within specified limits.

Some monitors have a static and one or more dynamic focus controls. The sequence for adjusting them and the areas of the screen they affect depend on the monitor under test.

Master

Description



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MoireX, MoireX33, MoireY, MoireY33

Description

The MoireX and MoireY images consist of black lines on a white background across the active video area. MoireX provides vertical lines; MoireY provides horizontal lines. The MoireX image is shown below.

The primary version of the MoireX33 and MoireY33 images provide a black frame around the black lines. The secondary version draws a white frame around black lines. The primary version of the MoireX33 image is shown below.

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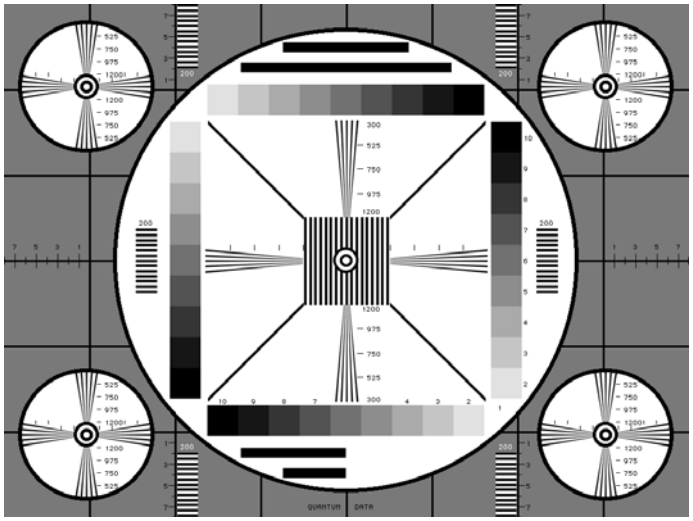
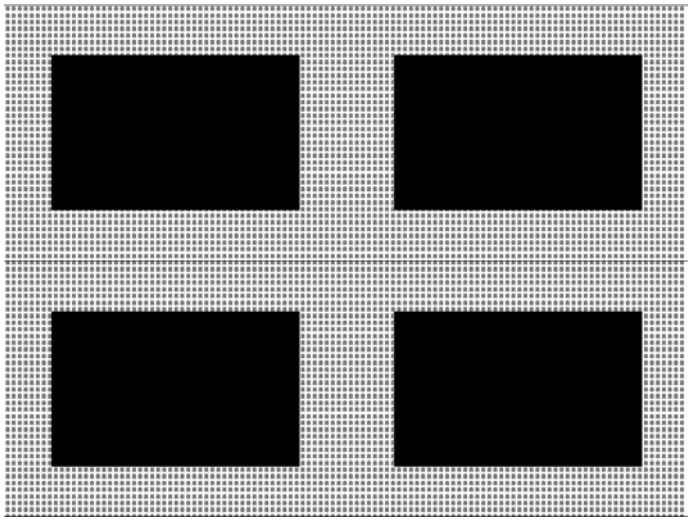
Monoscop

Description



MSony7, MSony8

Description Special test image developed per customer specifications. Primary version of the MSony7 image is shown below. The secondary version draws white boxes and characters with a black background.



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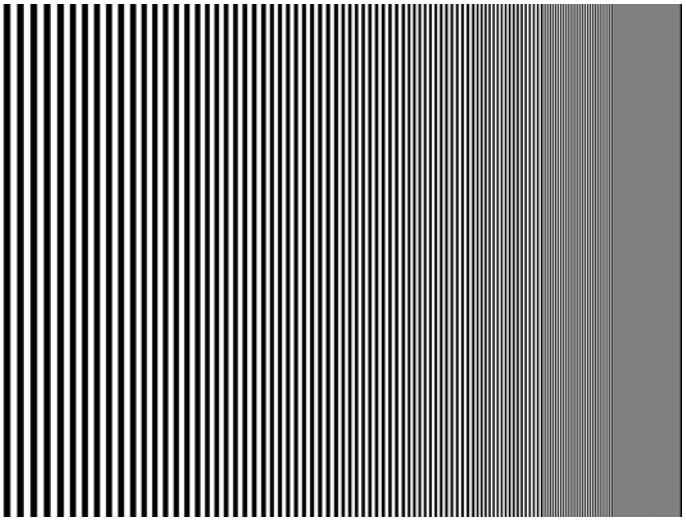
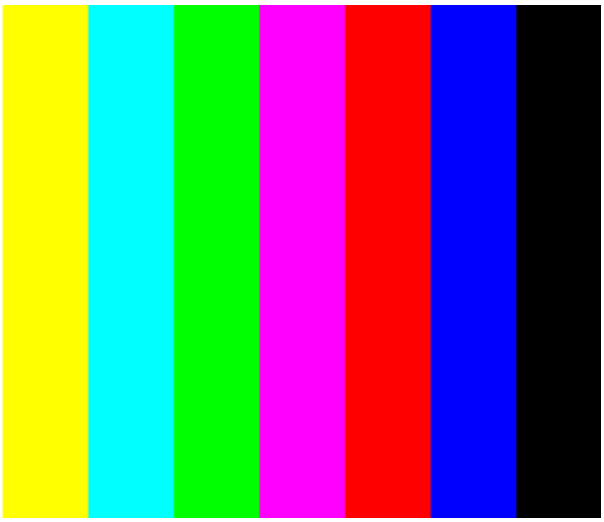
MulBurst

Description



Orion

Description This image provides a color bar that rotates (shifts) the bars to the right on an incremental basis.



The color bars are shifted to the right at 3 second intervals. After pressing the **Step** key, turn the **Image** knob to adjust the interval between 3, 10, 30 and 60 seconds.

Outline0, Outline1, Outline2, Outline3

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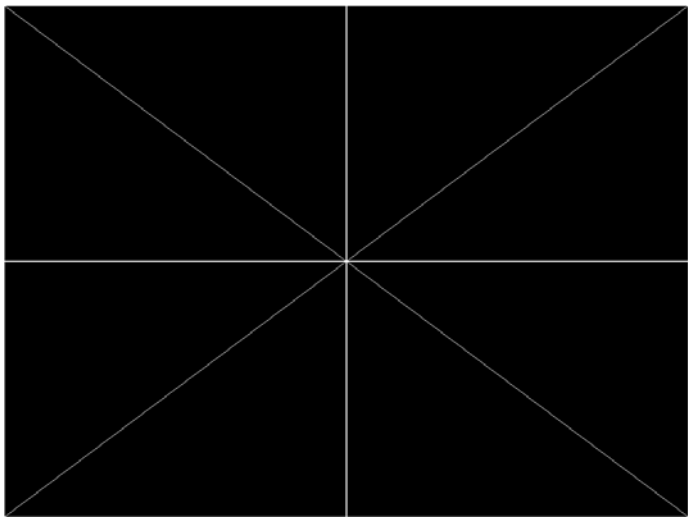
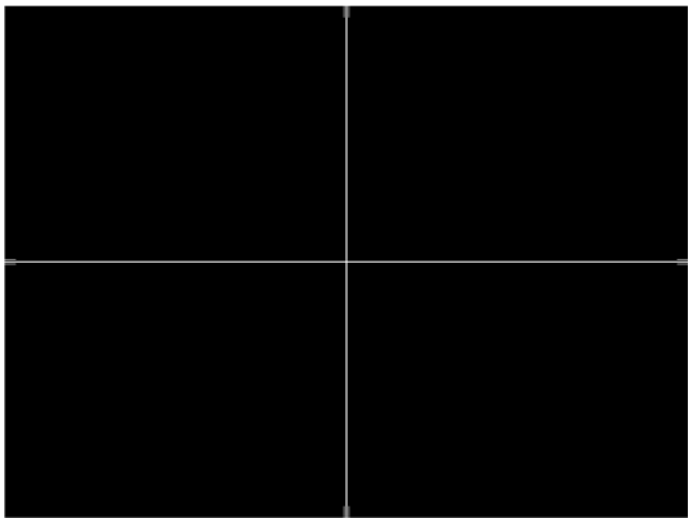
Description The primary version of the Outline0 image consists of a rectangular white border on a black background. The border is one (1) pixel wide and defines the active video area. Two (2) diagonal lines join the opposite corners. A-full size cross is centered in the image. The horizontal line of the cross is one (1) pixel thick for formats with an odd number of active lines and two (2) pixels thick for formats with an even number of active lines. The vertical line of the cross is one (1) pixel thick for formats with an odd number of active pixels per line and two (2) pixels thick for formats with an even number of active pixels.

The secondary version of these images draw black lines on a white background.



In the Outline1 version, the two diagonal lines are removed and short marker lines are added to the border lines near to where the cross lines meet the border lines. The markers appear at both sides of the cross lines. The distance between the marker lines and the cross lines is the greater of either two (2) pixels or one (1) millimeter.



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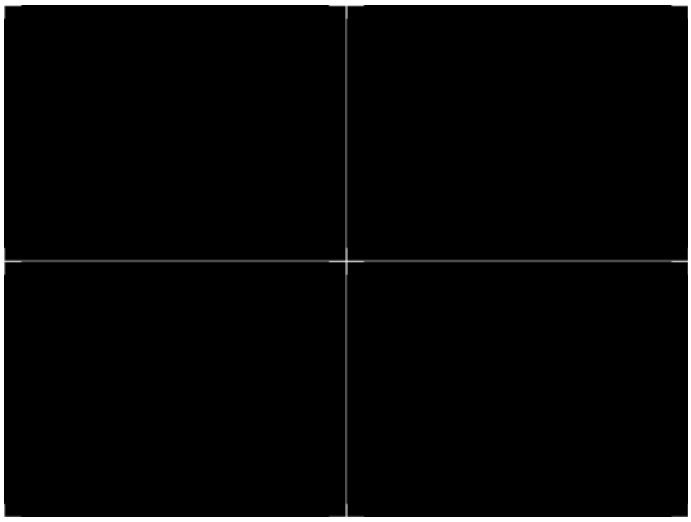
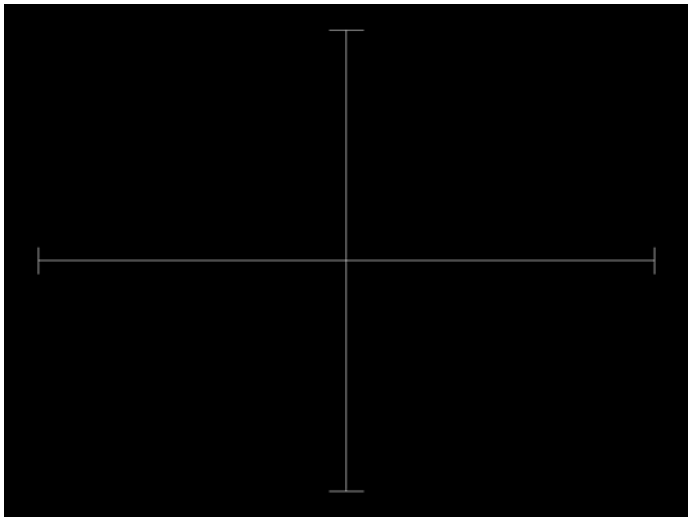
In the Outline2 version, the two diagonal lines are removed and short marker lines are added to the corners, and where cross lines meet and end.



In the Outline3 version, the two diagonal lines are removed, cross lines are shortened, and short marker lines are added.



Test Yoke tilt correction

Purpose The horizontal axis of a displayed image should line up with the horizontal axis of your monitor. Any tilt is likely due to the yoke being rotated on the neck of the CRT. A rotated yoke makes any displayed image appear rotated.

Method Place your monitor on a flat surface so the face of the CRT is perpendicular to the surface. Use a ruler or gauge to measure the height of each end of the image's horizontal center line from the surface. The difference between the two readings should be within

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specification for the monitor. If it is out of specification, the yoke must be adjusted. Loosen the hardware that clamps the yoke to the neck of the CRT and rotate the yoke until the line is horizontal. Tighten the yoke-clamp hardware.

Test Yoke winding orthogonality check

Purpose The horizontal and vertical deflection coils on the yoke should have their axes cross at exactly 90 degrees. Improper orientation of the windings causes displayed rectangles to look more like nonorthogonal parallelograms. This type of defect is almost impossible to correct with adjustments. It is usually easier to replace the defective yoke.

Method First, perform the yoke tilt correction described above. The vertical center line of the image should be perpendicular to the work surface. If the deviation is beyond specification, the monitor should be rejected and sent back for repair, rather than trying to magnet a defective yoke.

Test Display size correction

Purpose A too-large active video size adjustment on a monitor may cause information to be lost around the edges of the screen. A too-small active video size adjustment may make some displayed information hard to read. The correct size is needed to obtain the correct aspect ratio. You need the correct aspect ratio to get round circles and square squares.

Method First, determine the correct physical size of the active video area for the display. This information usually is given in a display's specification sheet or service manual. The size should match the sizes in the format you are using. The size setting of the current format can be checked using the Format test image.

Place a ruler or gauge along the horizontal line of the image and adjust the monitor's horizontal size control until the distance between the end points matches the specified value.

Move the ruler or gauge to the vertical line and adjust your monitor's vertical size control until the distance between the end points matches the specified value.

Test Parallelogram distortion check

Purpose Parallelogram distortion is very difficult to correct with magnets because the correction often causes barrel distortion. Therefore, you should decide early whether your monitor meets this specification. The problem usually can be traced to the improper winding of the yoke coils. If the problem is not too severe, it may be corrected by adding or adjusting magnets on the yoke. However, if the distortion is excessive, it may be an indication of a defective yoke which cannot be corrected with magnets.

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Method Measure the lengths of the two (2) diagonal lines. Any difference is an indication of parallelogram distortion. The difference in readings should be within the specifications of the monitor.

If the difference in the readings is too far beyond specification, the monitor should be rejected and sent back for repair, rather than trying to magnet a defective yoke.

Test Trapezoid distortion correction

Purpose This image gives you a way to measure trapezoid distortion in your monitor. If the distortion is not too severe, you may be able to correct it by adding or adjusting magnets on the yoke.

Method Perform the yoke winding orthogonality check and parallelogram distortion check first to avoid wasting time on a monitor with a defective yoke.

Measure the width of the image at the top and bottom of the display. Any difference in readings should be within the specification limits. Measure the height of the image at both sides of the display. Again, any difference in readings should be within specification limits. If either of the differences is out of specification, the trapezoid distortion of the monitor is out of specification.

Add or adjust magnets on the yoke to correct the problem. The pin and barrel distortion correction should be repeated to make sure that it is still in specification.

Test Pin and barrel distortion correction

Purpose If perfectly linear sweep signals are sent to a perfectly wound deflection yoke mounted on a perfect CRT, you would not necessarily get a perfectly formed raster. Instead you would likely get a raster that had its corners stretched away from the center, resembling a pin cushion. This distortion occurs because the geometry of the deflected electron beam does not match the geometry of the tube face plate. Also, imperfections in the yoke or CRT may affect this problem. In some cases one or more corners may be pulled towards the center of the raster causing it to look like a barrel. Uncorrected raster distortion carries over as distortion of the displayed image.

Method A slot gauge may be used to determine if the amount of pincushion or barrel distortion is within limits. A basic slot gauge may consist of a piece of opaque film with at least two (2) transparent slots in it. One slot is used for top and bottom distortion and the other is used for the sides. By positioning the correct slot over each portion of the border line, the entire line should be visible. If this cannot be done at all four sides, the monitor requires correcting.

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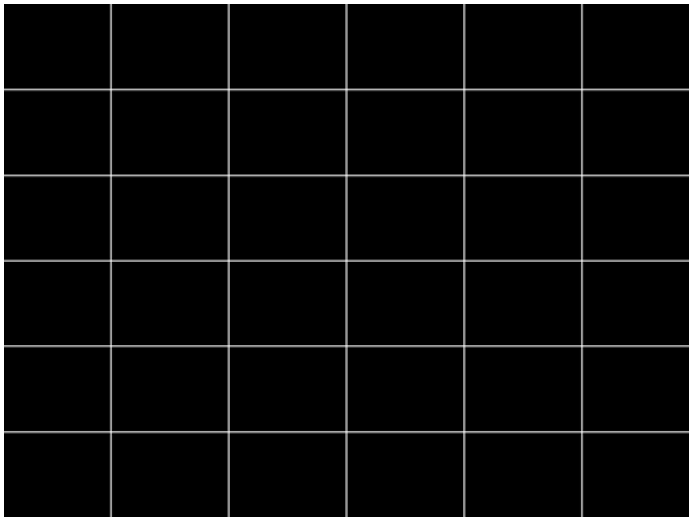
There are two main ways of correcting pincushion distortion. The first involves placing or adjusting magnets on the yoke. This is a trial-and-error method. However, skilled operators develop a feel for how strong a magnet to use and how to place it in order to get the desired correction. If any correction is performed, the trapezoid distortion correction should be repeated.

The other correction method involves adding correction signals to the deflection signal driving the yoke. This method is usually found in color monitors, where adding magnets to the yoke would cause problems with convergence and purity. The type and number of adjustments depends on the monitor being tested.

P1

Description This image is a 6x6 white crosshatch without a border on a black background.



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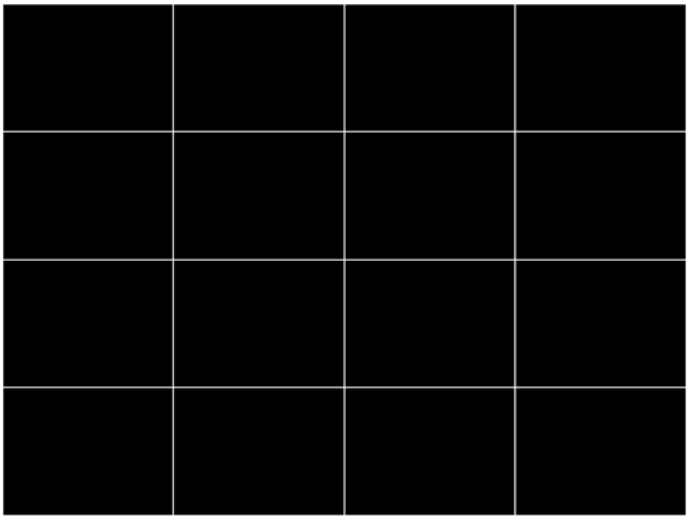
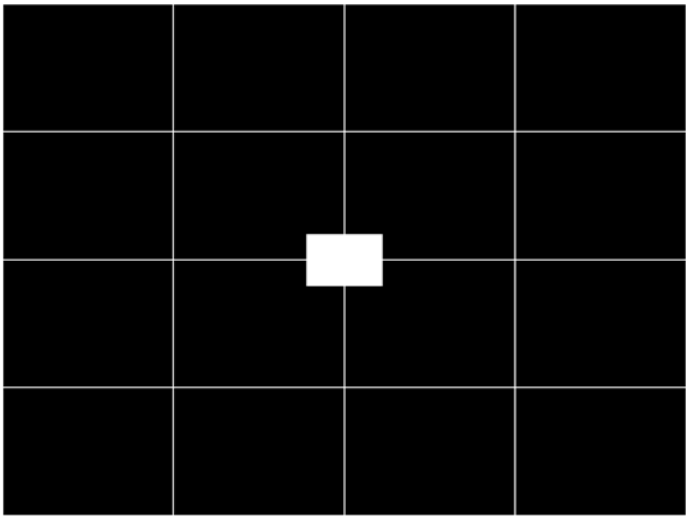
P2

Description This image is a 4x4 white crosshatch with a border on a black background.



P3

Description This image is a 4x4 white crosshatch with a border and a small, centered white patch on a black background.



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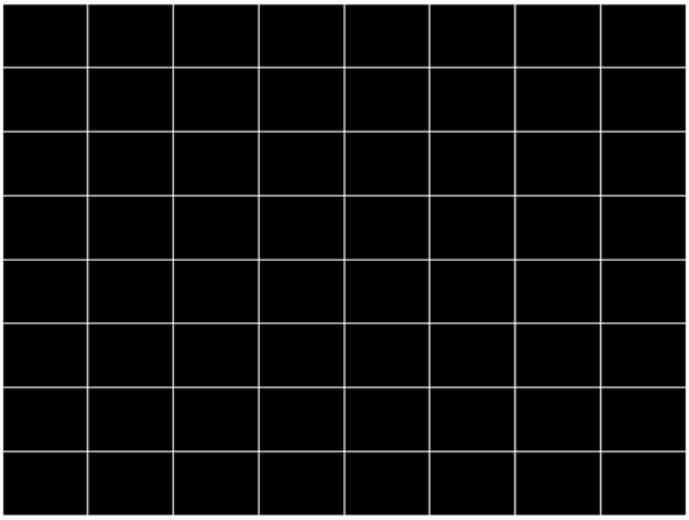
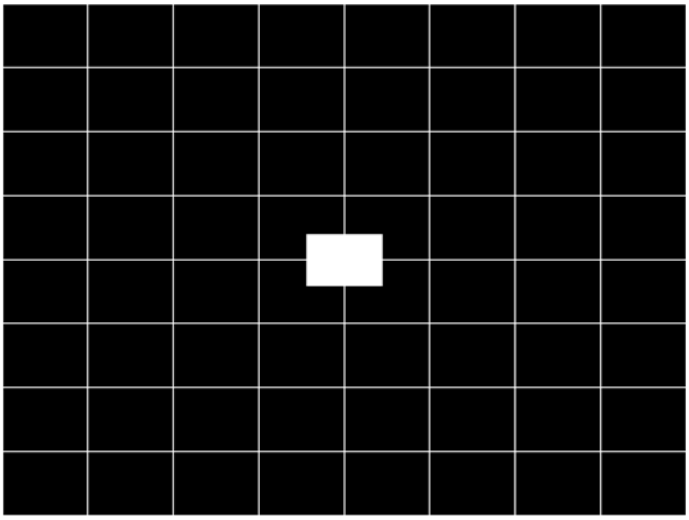
P4

Description This image is an 8x8 white crosshatch with a border on a black background.



P5

Description This image is an 8x8 white crosshatch with a border and a small, centered white patch on a black background.



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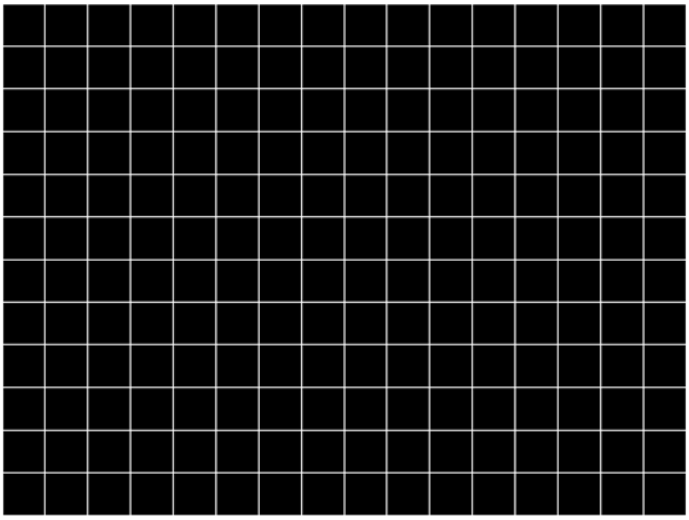
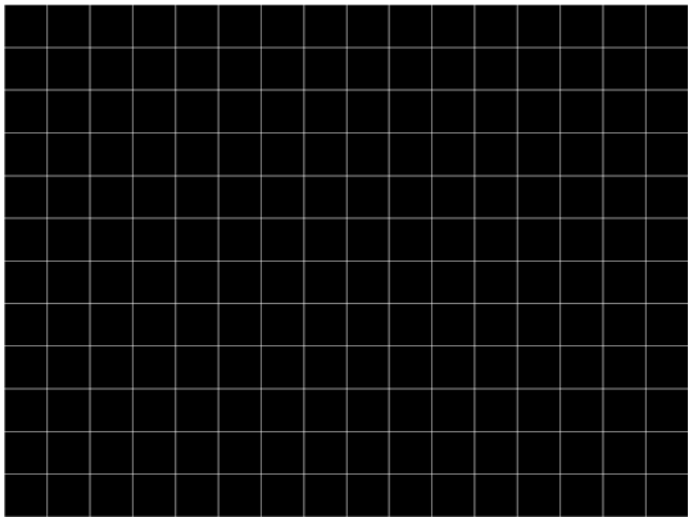
P6

Description 16x12 pixel white crosshatch with a border on a black background.



P6_Sony

Description 6x12 pixel white crosshatch with a border on a black background.



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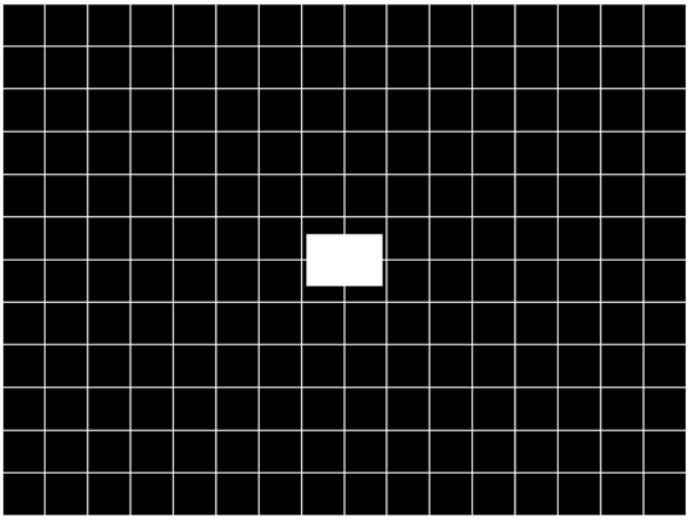
P7

Description 16x12 white crosshatch with a border and a small, centered white patch on a black background.



P8

Description This image is an all black active video area. The secondary version draws an all white video area.

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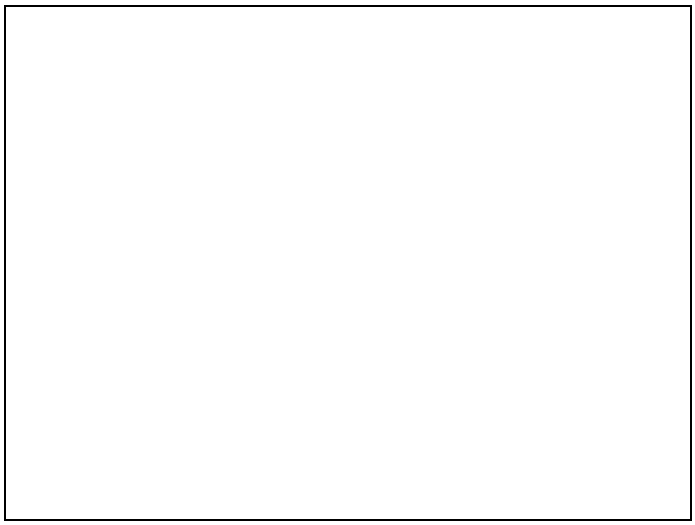
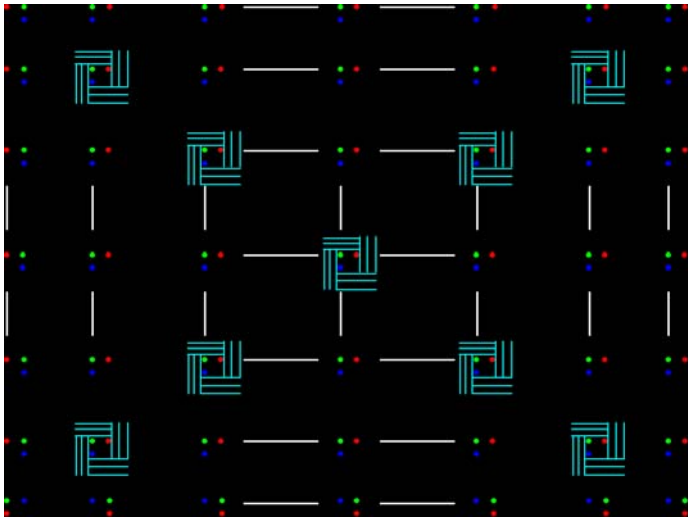
P9

Description This image is an all white active video area. The secondary version draws an all black video area.



P10

Description Special test image developed per customer specifications. There are four versions of this image.



After pressing the **Step** key, turn the **Image** knob to select up to 4 different versions of this image.

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PacketRx

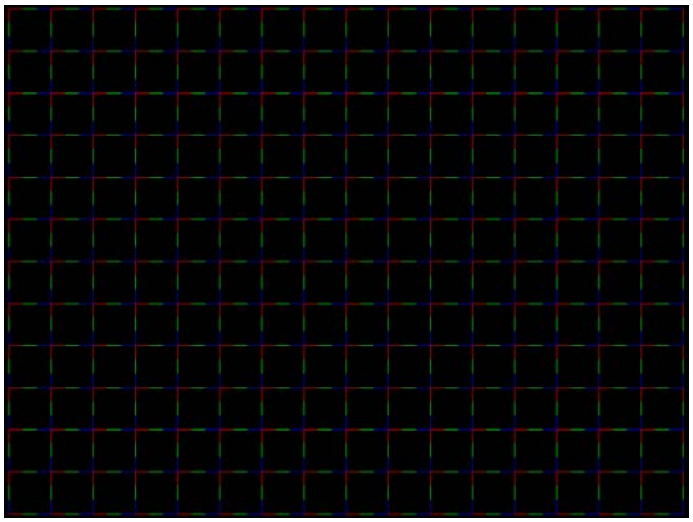
Description Displays the InfoFrame data received by HDMI receiver. For more information, see “Testing HDMI transmit device InfoFrame capability” on page 127.

PacketTx

Description Displays the InfoFrame data transmitted from the HDMI transmitter. For more information, see “Viewing InfoFrame contents” on page 161.

PdsCrt1

Description Special test image developed per customer specifications.



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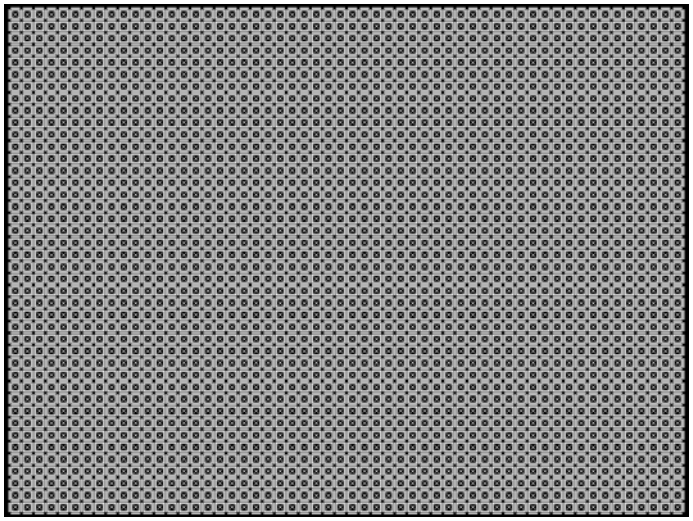
PdsCrt2

Description Special test image developed per customer specifications.



Persist

Description In the primary version, 15 small white boxes move back and forth between diagonal guide lines. The lines form 15 side-by-side tracks. The size of each box is scaled to the light meter box size set by the MSIZ system parameter. The image does the following:

- The box in the center track (marked “1X”) moves one scan line vertically and one pixel horizontally for each vertical frame of refresh.
- The seven boxes to the right of the center track (marked “2X” through “8X”) move 2, 3, 4, 5, 6, 7, and 8 pixels and lines per frame, respectively.
- The seven boxes to the left of the center track (marked “/2” through “/8”) move one scan line vertically and one pixel horizontally for every 2, 3, 4, 5, 6, 7, and 8 vertical frames of refresh, respectively. These boxes are at the bottom of the tracks.

In cases where the next move would cause the box to move beyond the end of its track, it immediately reverses and moves the correct distance in the opposite direction for the next frame.

A continuously-running counter appears in the upper left corner of the image. The number shown is the number of vertical frame refreshes that have occurred since the generator was first powered up.

The secondary version draws a black image on a white background.

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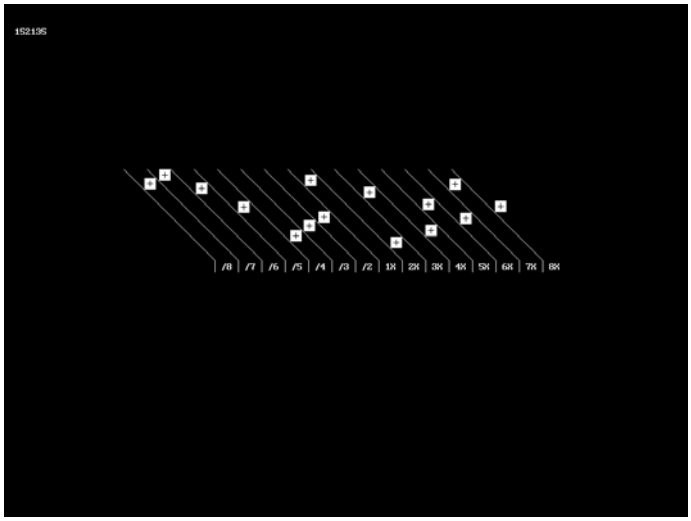
An example of the primary version of the Persist image is shown below:



Test Phosphor persistence

Purpose The phosphors on the face of most CRTs continue to glow for a short period of time after the electron beam has stopped energizing them. This phenomenon is called persistence. A certain amount of persistence is desirable in most applications. It prevents a flickering of a displayed image that most users would find objectionable. On the other hand, a CRT with an overly long persistence time causes moving objects to leave a blurred trail.

Method A flickering in the slower moving boxes indicates that the combination of refresh rate and phosphor persistence is not suitable for long-term viewing.

A fading tail left behind by the faster moving boxes indicates that the display may not be suitable for viewing animated images.

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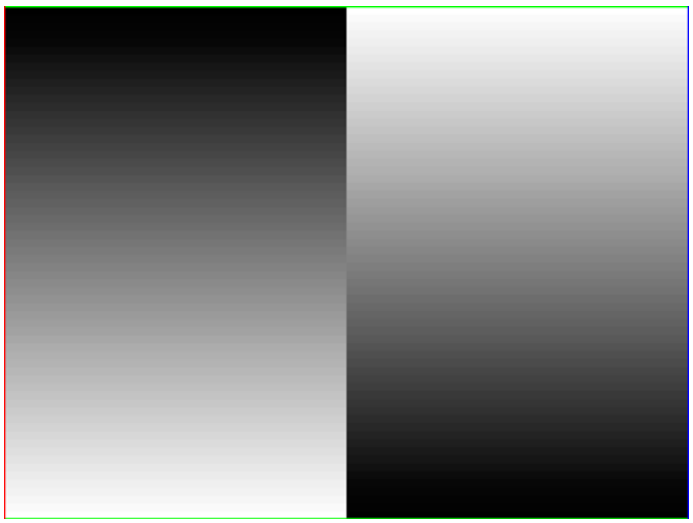
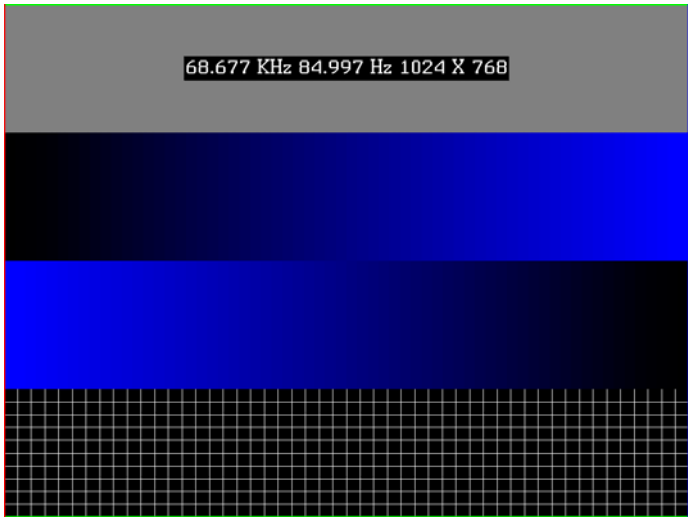
PgBar64H, PgBar64V

Description Special test image developed per customer specifications. The PgBar64H image is shown below.



PgCB, PgCG, PgCR, PgCW, PgCWrgb

Description Special test image developed per customer specifications. Primary version of PgCB is shown below. The secondary versions draw all white over the last bar.



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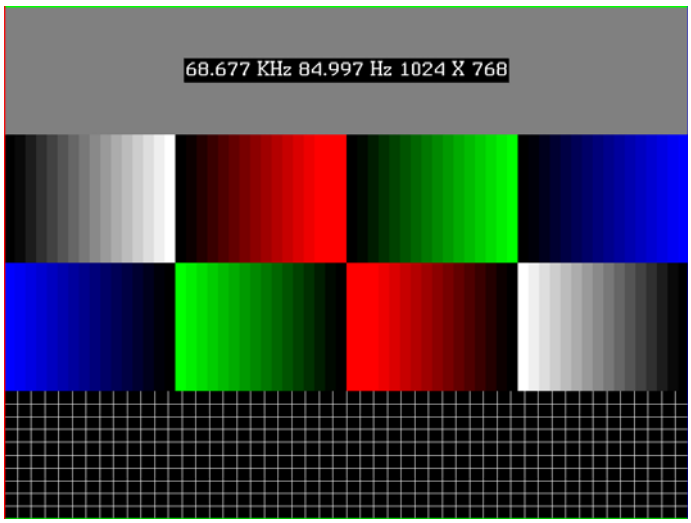
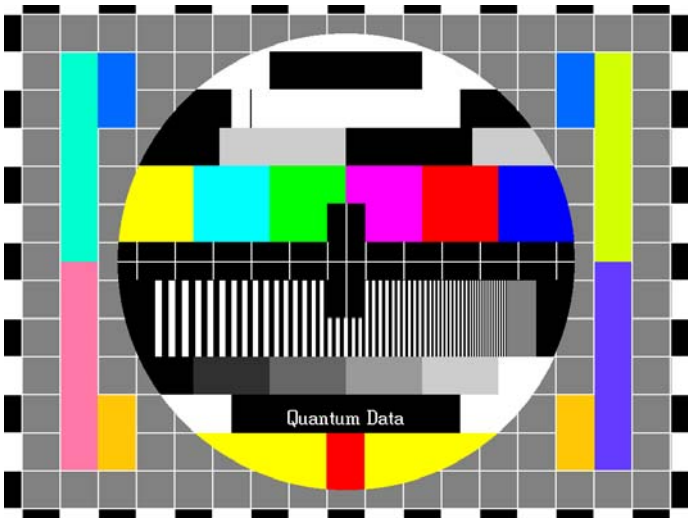
The PGCWrgb is shown below.



Philips1

Description Special test image developed per customer specifications.



PixelRep

Description Used to test HDMI pixel repetition. There are 10 different versions of this image to support the different pixel repetition settings. For more information, see “Testing HDMI video pixel repetition” on page 152.

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PRN24bit

Description This image displays pseudo-random noise using 24-bits-per-pixel color depth.

PRN_5, PRN_9

Description Used with analyer to verify the analyzer's pseudo-random noise analysis capability. The PRN_5 image introduces 5 pixel errors per color component, while the PRN_9 image introduces 9 pixel errors per color component. For more information, see "Testing accuracy of analyzer" on page 120.

The PRN_5 image is shown below.

PulseBar

Description This image is intended for TV formats, but can be displayed with any format up to 100 MHz. The image looks like two vertical lines followed by a wide vertical bar on a display's screen. The first line is a sine-squared modulated pulse that fades from black to red and

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back to black. The pulse is 20 T for PAL and 12.5 T for NTSC formats. The second narrower line is a 2 T white sine-squared pulse. T = 100 nSec for PAL and 125 nSec for NTSC formats. The wide bar is white with sine-squared edges.

Test Video system testing

This multi-purpose pattern can be used with other instruments to check television K factors. The modulated pulse can be used to check chrominance-to-luminance delay and gain. The narrow white line can be used to measure short term linear distortion (K2T).

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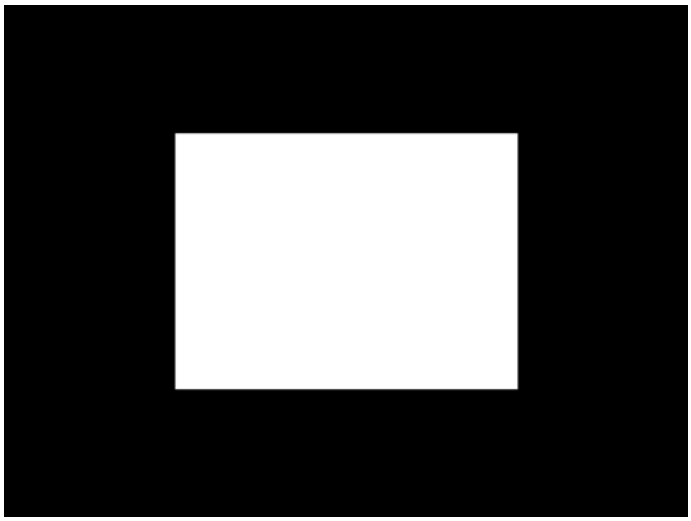
QuartBox

Description

The primary version (shown below) has a single white box in the center of active video. The size of the box is one-half the width and height of the active video area (a quarter of the entire active video area). The secondary version draws a black box on a white background.



Test

Brightness control adjustment

Purpose

The wrong brightness setting on your monitor may cause other tests such as Contrast, Focus, and Beam Size to be invalid. An accurate brightness setting helps give repeatable measurements throughout other tests. This version of the brightness box should be used if the display's specifications call for the brightness to be set with one-fourth of the screen lit.

Method

Place your light meter probe within the center box and adjust the monitor's brightness control to obtain the required light meter reading.

Notes

The color of the center box is a special color, named foreground. The FRGB command can be used to change the default color of foreground to any RGB value.

```
IMGL quartbox: ALLU     // loads QuartBox image
FRGB 122 122 122        // sets RGB color of box
```

After loading a different format, send the FRGB command again to set the box fill color.

If you want to draw your own box, use foreground as the fill color, and then use the FRGB command to define the color of "foreground." For example:

```
IMGL raster; ALLU     // clears display
RECT foreground 100 100 100 100 dither100
FRGB 128 128 0
FRGB 192 192 64
```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```
FMTL DMT0660; ALLU
FRGB 192 192 64
```

Ramp

Description

This image provides an active video area starting from full black (+7.5 IRE) at one edge of the screen to full white (+100 IRE) at opposite end of the screen.

There are 4 versions of this image—one for each edge of the display.

When selected, this image is displayed.

After pressing the **Step** key, turn the **Image** knob to change the image starting point to left, right, top, or bottom.

RampX

Description

This image provides a ramp image that continuously sweeps (moves) to the right on an adjustable time basis.

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When selected, this image is displayed.

After pressing the **Step** key, the image moves to the right. Adjust the speed using the **Image** knob (turn clockwise to slow down the image).

Ramp_B, Ramp_G, and Ramp_R

Description The active video area goes from full black (+7.5 IRE) at the left edge of the screen to full blue (_B), green (_G), or red (_R) at the right edge. The Ramp_B image is shown below.

Test Video gain linearity

Method When viewed on a TV screen, the full range of grays should be visible. There should be no color shifts visible.

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Raster

Description The primary version shows a totally black display (nothing being displayed). The secondary version shows a totally white display.

Test Raster centering

Purpose Many monitor applications require that the displayed image or text fit completely within a bezel that surrounds the CRT. This usually requires that you first center the blank raster on the face of the CRT, and then center the image within the raster. Use this image for centering the raster on the CRT.

Method Turn up your monitor's brightness control until the raster is just visible. Adjust the raster's position and size using the size and raster centering controls. The raster centering adjustment for many monochrome monitors consists of moving magnetic rings on the deflection yoke.

Regulate

Description The image cycles between two (2) patterns. In the primary version, the first pattern is a white outline that defines the edges of displayed video. The other pattern has the same outline plus a solid white rectangle in the center. The size of the solid rectangle equals 95% of the height and width of displayed video. The speed of the cycle cannot be changed. The secondary version has a thick white frame with a black center for the first pattern and a solid white active video area for the other pattern.

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The first pattern of the primary version is shown below.

Test High voltage regulation

Method The size of the border should not change for each half of the image. The change in border size between the two images should be within the specification limits of the monitor.

Samsung1, Samsung2

Description Special test images developed per customer specifications. The image consists of three small simulations of Microsoft Windows® screens on a blue background (Samsung1) or black background (Samsung2). A border and centered cross are formed with repeating

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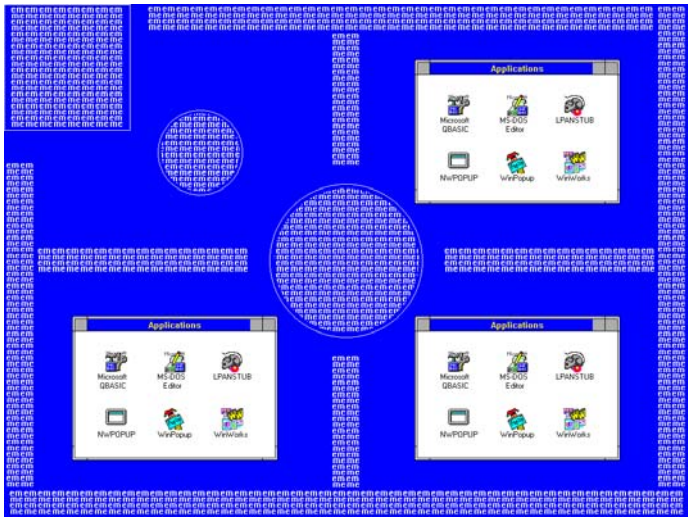
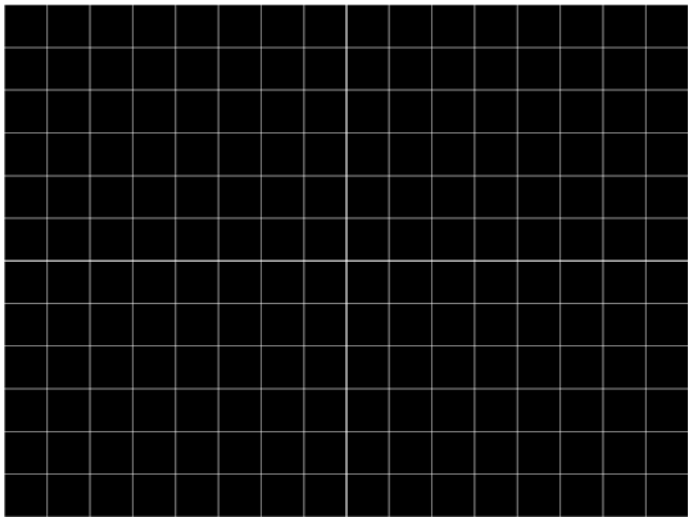
groups of the characters “e” and “m”. The repeating characters are also used to form a rectangular patch in the upper left hand corner and a circular area in the center of the image. The secondary version of Samsung2 draws a white background.



Samsung3

Description Special test image developed per customer specifications.



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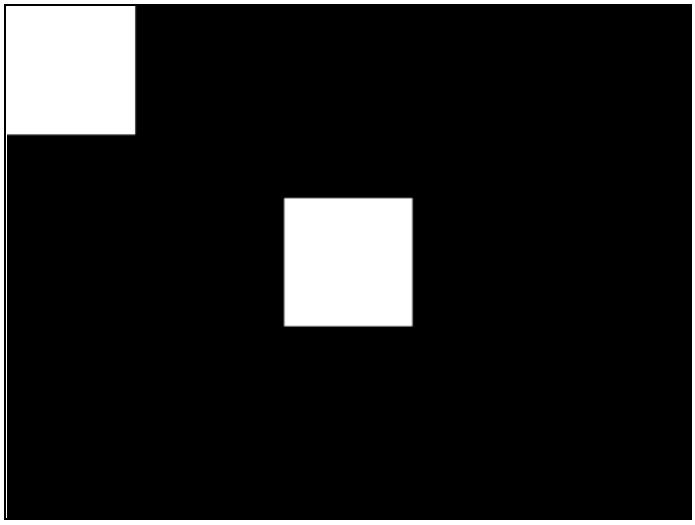
Samsung4

Description Special test image developed per customer specifications.



Samsung5

Description Special test image developed per customer specifications.

Samsung6

Description Special test image developed per customer specifications.

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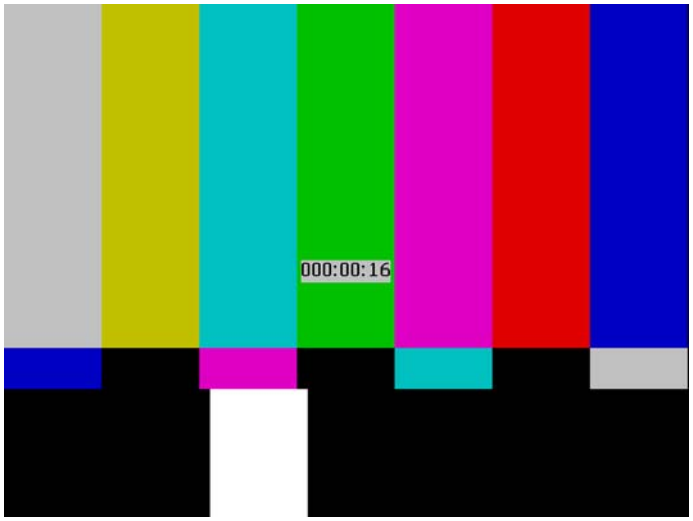
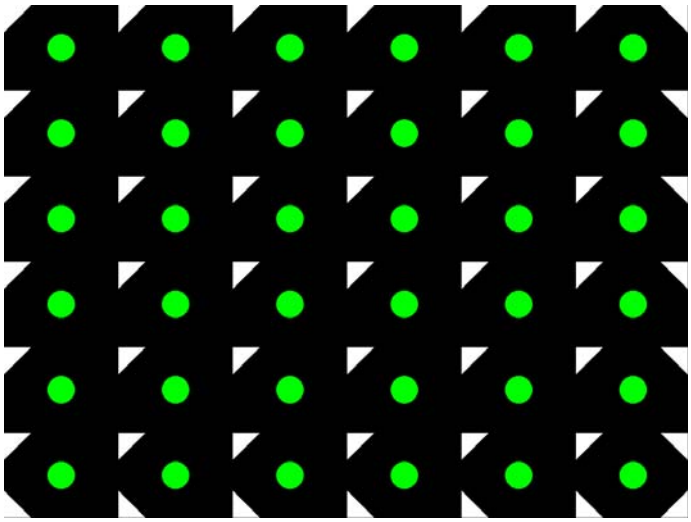
SamsungB

Description Special test image developed per customer specifications.



SamsungT

Description Special test image developed per customer specifications. There are four versions of this image. When selected, the following image is displayed.



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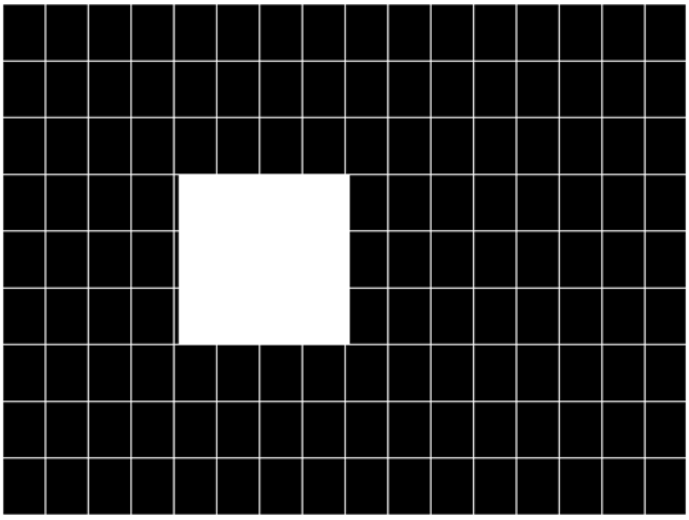
SlideBox

Description This image displays a 16x9 white crosshatch with a large white patch moving across the screen.



To change the animation speed:

1. Load the SlideBox image.
2. Establish a terminal session with the generator (see page 14).
3. Enter the following commands:

```
ISUB 1
IVER 1
IMGU
DELX 10;
IMGU
DELX 20;
IMGU
```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SlideX

Description This image displays a black background with a large white vertical bar moving across the screen.

After pressing the **Step** key, the speed of vertical bar movement can be increased by turning the **Image** knob (turn clockwise to speed up image).

To change the animation speed using the command-line interface:

1. Establish a terminal session with the generator (see page 14).
2. Load the SlideX image.
3. Enter the following commands:

```
ISUB 1
IVER 1
IMGU
DELX 10;
IMGU
DELX 20;IMGU
```

SMPTE133

Description This image is based on a recommended practice (RP-133) test pattern designed by the Society of Motion Picture and Television Engineers (SMPTE). The original application was used in testing and evaluating medical imaging monochrome displays. The image now is

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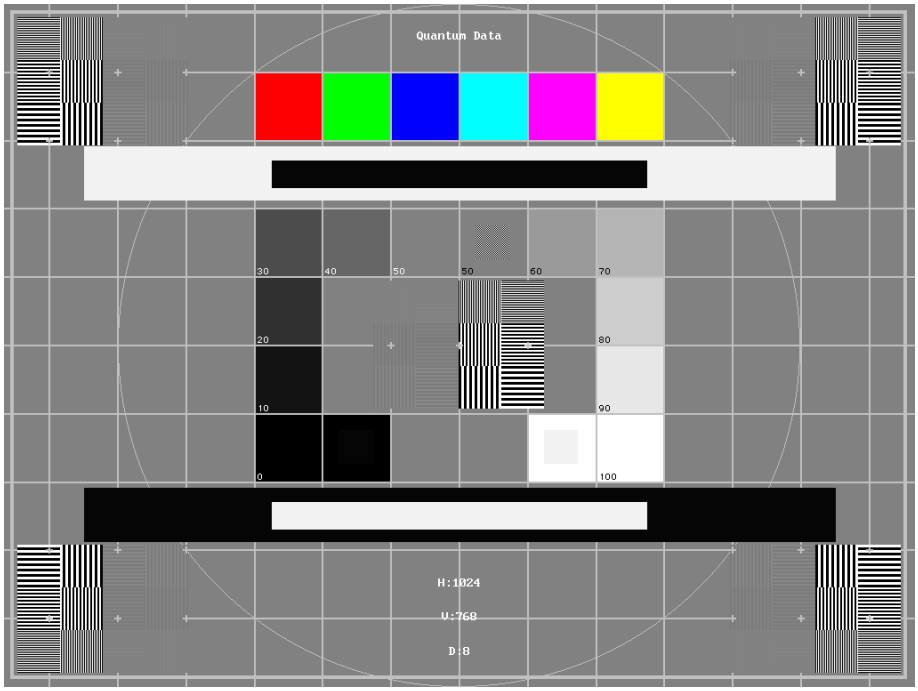
used in many different display applications. The image is self-scaling as to the number of active pixels and active lines used. Some of the image's elements have minor differences from the original SMPTE specification.



These differences are noted in descriptions of the individual elements.

- The image is drawn on a reference background having a 50% intensity level. The background covers the entire active video area.
- **Crosshatch** – There are 10 boxes vertically. The number of horizontal boxes is based on the physical aspect ratio determined by the HSIZ and VSIZparameters in the currently loaded format. The boxes are perfectly square with any fractional spaces placed around the outside edges of the image. The vertical lines are two (2) pixels thick while the horizontal lines are two (2) scan lines thick. Small crosses indicate the intersection of the horizontal and vertical lines when they are covered by other parts of the image. All parts of the crosshatch are normally drawn using a 70% intensity level. A 75% level is used in the secondary version.
- **Resolution patch** – The patch is made up of six (6) smaller boxes that are each about 6.25% of the height of the display. The boxes are made of alternating intensity (0 and 100%) stripes. The stripes run vertically and horizontally. The stripes may be one (1), two (2) or three (3) pixels wide each. Details of the patch are shown in the lower half of the following illustration. The patches are located in each corner of the main image and in the center. They are oriented with the highest resolution and contrast boxes closest to the outside corners. The 48%-53%, 48%-51% and 50%-51% level patches are omitted in the secondary version.
- **Grayscale boxes** – Twelve (12) boxes at eleven (11) intensity levels are clustered around the center of the main image. They start at 0% and increase in 10% steps to

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100% with two (2) boxes at a 50% level. All of the grayscale boxes are omitted in the secondary version.

- **Gamma check dither box** – A small box is drawn inside the right-hand 50% grayscale box. The box is half the width and height of the larger box. The box consists of a checkerboard of alternate one-on and one-off pixels. The alternate pixels have levels of 0 and 100%. This smaller box is not part of the original SMPTE specification and is omitted in the secondary version.
- **Contrast boxes** – Two (2) boxes are drawn adjacent to the grayscale boxes. They are at 0 and 100% levels. There are smaller boxes drawn inside each box at 5 and 95% levels. The contrast boxes are omitted in the secondary version.
- **Black and white windows** – Two (2) horizontal bars are located above and below the grayscale boxes. Their height equals 8% of the display height. There are half-size bars centered in the larger bars. In the primary version, the dark portion of the windows is at a 5% level and the bright portion is at a 95% level. Zero and 100% levels are used in the secondary version.
- **Border** – A border line is drawn around the image. It is set in from the edges of displayed video a distance equal to 1% of the displayed height and has a thickness equal to 0.5% of the displayed height. The intensity level is the same as that of the crosshatch lines.
- **Circle** – A large circle is centered in the image. It touches the top and bottom of the active video area when the aspect ratio is wider than it is high (landscape-type display). The circle touches the left and right sides of active video when the aspect ratio is taller than it is wide (portrait-type display). The intensity level is the same as that of the crosshatch lines. The circle is not part of the original SMPTE specification.
- **Resolution data** - The number of active pixels per line and the number of active lines is shown as text below the lower black and white window. The pixel depth also is shown. The intensity level of the text is the same as that of the crosshatch lines. The displaying of the data is not part of the original SMPTE specification.

  The secondary version adds a row of six (6) color bars above and below the black-and-white windows. The order of the colors, from left to right, is red, green, blue, cyan (g+b), magenta (r+b) and yellow (r+g). The top row is drawn at 100% intensity levels and the bottom row is drawn at 50% intensity levels. Color bars are not part of the original SMPTE specification.

Test Deflection linearity

Method If the overall height and width of the display's active video area match the sizes in the format, the large circle should be perfectly round. Each box in the crosshatch pattern should be the same size and shape. For more information on testing linearity, refer to the Linearty test image on page 658.

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Test High contrast resolution

Method All the 0 and 100% level stripes in all the resolution patches should be separate and distinct.

Test Low contrast resolution and noise

Method All the mid-level 2 on - 2 off stripes in all the resolution patches should be visible and distinct. This is a sensitive test for noise in the display's video amplifiers.

Test Quick gamma check

Method The average brightness level of the small gamma dither box should match the brightness of the larger surrounding box. This is a visual check to see if the display's gamma correction is producing the correct mid-level response.

Test Video gain linearity and gamma

Method The individual grayscale boxes all should be at their indicated levels. A small aperture photometer is usually required to get accurate and repeatable readings.

Test Contrast and brightness check

Method On a display with properly adjusted brightness and contrast controls, both the 5% and 95% contrast boxes should be clearly visible inside their larger surrounding 0% and 100% boxes.

Test Video amplifier stability

Method The two black-and-white windows should show sharp transitions between the smaller box and the surrounding window. Streaking may be an indication of undershoot or overshoot while ghost images may indicate a ringing problem.

Test Excessive overscan and off-center alignment

Method The entire border should be clearly visible on the face of the tube and not be hidden by the edge of the glass or by any bezel.

Test Interlace flicker

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Method The horizontal 1 on - 1 off stripes in the resolution boxes should not have objectionable flicker when shown with an interlaced format. Excessive flicker indicates that the combination of the display's CRT persistence and frame scan rate is below the persistence time of the human eye.

SMPTEbar

Description This image is based on an engineering guideline (EG1-1990) test signal specified by the Society of Motion Picture and Television Engineers (SMPTE). The SMPTE pattern, in turn, is derived from an EIA standard test pattern (RS-189-A). The image, is set up to be generated by an 801GX generator as an encoded TV output. It is designed for adjusting the color settings of a television monitor by eye. It can also be used with a TV waveform analyzer and vectorscope for testing video signal processors and color decoders. The image is available on all models as a component RGB signal. Some of the image's elements have some differences from the original SMPTE specification.

These differences are given in descriptions of the individual elements.

- The upper 67% of the image consists of a series of color bars. These bars match the order of the bars in the SMPTE and EIA patterns. They are similar to the 801GX's TVBar_75 image without the last black bar.
- The left side of the lower 25% of the image contains isolated -I and Q color difference signals that match the original EIA and SMPTE patterns. The -I signal appears as a bluish-gray bar and the Q signal appears as a purple bar on a TV monitor. The bars are separated by a white (+100 IRE) bar.
- The right side of the lower 25% of the image contains a narrow 12.5 IRE gray bar. Due to a hardware limitation on the 801GX, this portion of the pattern does not match the original EIA and SMPTE patterns. The original patterns had +3.5 (blacker than black) and +11.5 IRE bars separated by a +7.5 IRE (black) bar.

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- The remaining central 8% of the image contains a row of chroma set bars. These bars are part of the SMPTE pattern but are not in the EIA pattern. The order of the alternating color and black bars matches those in the SMPTE pattern.

Test Color video performance

Purpose This general purpose pattern can be used to check the video handling capabilities of most parts of a television system.

Method When viewed on a TV screen, all of the upper color bars should be correct and in the order shown. The hue and intensity of each bar should be uniform over the entire bar.

The image can be used with a TV waveform analyzer to check the performance of a video system. The upper color bars, as they would appear on a waveform analyzer, are shown on a previous page.

Test Color decoder performance

Purpose The image can used with a TV vectorscope to check for proper operation of a video color decoder. Vectorscope signatures of the upper and lower portions of the image using NTSC encoding can be found on the previous page.

Method The vectorscope signature for the color bars should hit the target test point for each color on the vectorscope's graticule. If you are using PAL encoded video, the signature will be similar to the one shown for the TVBar_75 test image on page page 702.

The three "legs" of the vectorscope signature for the -I and Q color difference signals should match the Burst, -I and Q reference lines on the vectorscope's graticule.

The following tests are based on the original SMPTE guideline:

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Test Visual chroma gain adjustment

Method To perform this test, you must have a way of turning off the red and green guns in the monitor under test. Turning off the red and green video components of the 801GX generator's video output will not work for this test.

This test uses the upper and central color bars. Switch off the red and green guns on the monitor. This will produce four blue bars, separated by black bars. Adjust the chroma gain so that the brightness of each outer blue bar is uniform over the entire bar. The gain is correct when the bottom 10% of each bar is the same brightness as the rest of the bar.

Test Visual chroma phase adjustment

Method In order to perform this test, you must have a way of turning off the red and green guns in the monitor under test. Turning off the red and green video components of the 801GX generator's video output will not work for this test.

This test uses the upper and central color bars. Switch off the red and green guns on the monitor. This will produce four blue bars, separated by black bars. Adjust the chroma phase so that the brightness of each of the two central blue bars is uniform over the entire bar. The phase is correct when the bottom 10% of each bar is the same brightness as the rest of the bar.

Test Visual black level adjustment

Method This test uses the lower right hand portion of the image. Reduce the black level until the gray bar disappears. Slowly increase the black level until the bar just becomes clearly visible.

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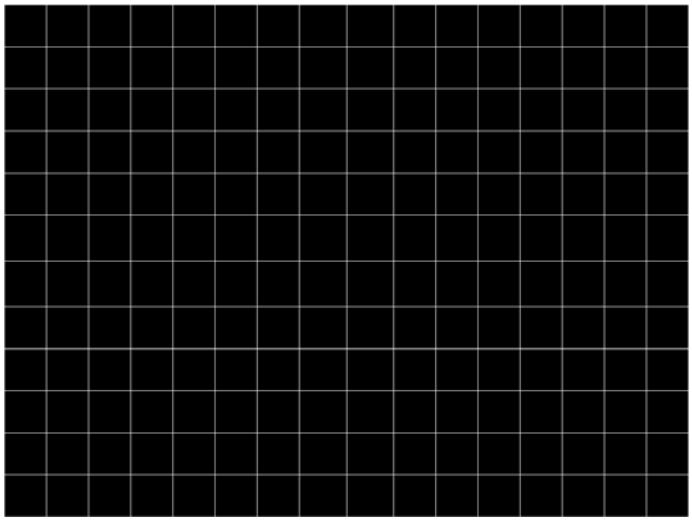
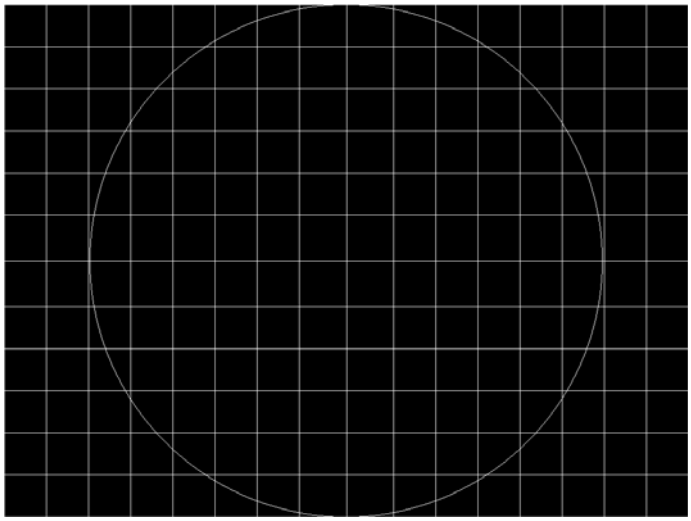
Sony6

Description Special test image developed per customer specifications.



Sony6WLC

Description Special test image developed per customer specifications.



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sRGBflat

Description

For testing color response per Microsoft's WinColorKit standard. This standard was developed by Microsoft to standardize methods relating to the matching of colors appearing on various displays (go to *http://www.microsoft.com/whdc/hwdev/tech/color/ColorTest.mspx* for more details). There are 38 different versions of this image to support this feature.

When selected, a flat image appears with a color that is remembered from the last time the image was set up. The example below shows version 8 (Red1) of the sRGBflat image:

A small label in the upper left corner of the image indicates the Microsoft name for the color that is currently being displayed (for example, "sRGB-Gray5"). Note that some of the names that appear conflict with generator color names (for example, "sRGB-Gray5" is not the same as the generator color "Gray5").

After pressing the **Step** key, turn the **Image** knob to select up to 38 different versions of this image. Each image displays another WinColorKit color.

Note: *For more information of generator support for Microsoft WinColorKit, go to* *http://www.quantumdata.com/support/kb/article.asp?kbid=100152*.

Staircas, Stairs20

Description

The active video area goes from full black at the left edge of the screen to full white at the right edge. There are six (6) steps (Stairs20) or sixteen (16) steps (Staircas).

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The Stairs20 image is shown below.

Test Video gain linearity

Method When viewed on a monitor's screen, a black bar plus five (5) gray bars should be visible. There should be no color shifts, and each of the bars should be uniform in color.

The image also can be used with an oscilloscope or TV waveform analyzer to check the gain linearity and gamma correction of a video system.

Strokes0, Strokes1

Description This image may cited by some display manufacturers' test procedures. The Strokes0 version consists of multiple groups of separated red, green and blue horizontal lines drawn on a black background. The Strokes1 version consists of multiple groups of separated red, green and blue diagonal lines drawn on a black background.

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The Strokes0 image is shown below.

Purpose These images are special-purpose test patterns used in test and alignment procedures specified by some display manufacturers.

Text_9, Text_9T, Text_11, Text_12T, Text_16

Description In the primary versions, the screen is filled with random paragraphs of white text on a black background. The amount of text is determined by the size of the font used and the horizontal and vertical resolution of the format. The Text_16 image uses a larger font than the Text_9 image. The secondary versions use black text on a white background.

The primary version of the Text_9 image is shown below.

Test Word processor simulation

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Purpose If your monitor is used in word processor workstations or other applications that call for large amounts of text to be displayed, you can use this image to simulate actual user conditions.

Method Select a suitable font size and text color. Adjust your monitor's brightness and contrast controls to obtain the best image. The characters in all areas of the display should be well formed and in focus.

TintAlign

Description

Toshiba

Description Special test image developed per customer specifications. There are two sub images, the secondary image is depicted below. The top half of the image has three small boxes (red, green, blue) with the upper left half at 92.7% luminence and the upper right half at 50%

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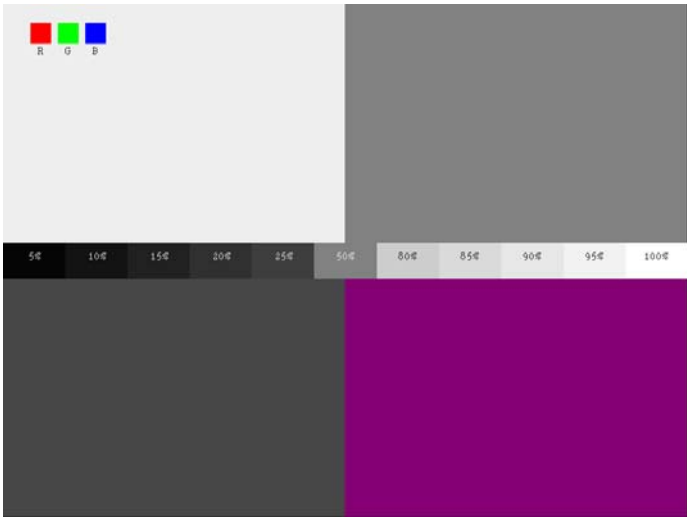
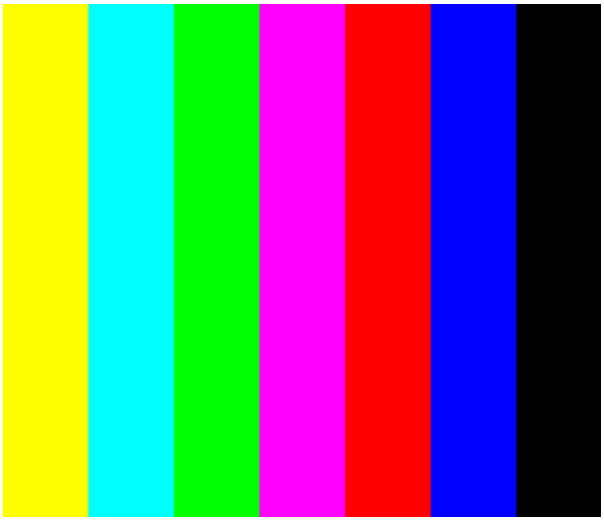
luminence. There is a series of 11 small boxes of increasing luminence left to right with the luminence identified in text. The lower left quarter of the image is 28.5% luminence and the lower right is magenta at 44.3 IRE.



TVBar100 & TVBar_75 (TV formats only)

Description The image consists of seven vertical bars that fill the entire active video area. The color and order of the bars is shown in the figure below. The TVBar100 image has a peak video level of 100 IRE and the TVBar_75 image has a peak video level of 75 IRE.

The TVBar100 image is shown below.



Test Color video performance

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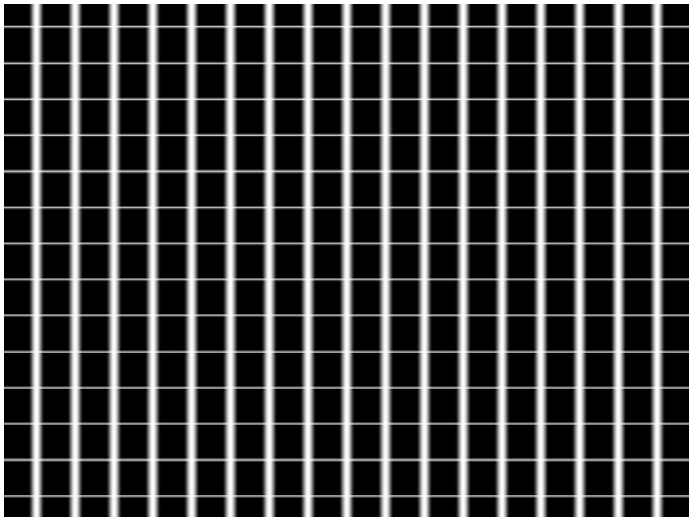
Purpose This general purpose pattern can be used to check the video handling capabilities of most parts of a television system.

Method When viewed on a TV screen, all of the colors should be correct and in the order shown. The hue and intensity of each bar should be uniform over the entire bar.

The image can be used with a TV waveform analyzer to check the performance of a video system. Individual scan lines of each image, as they would appear on a waveform analyzer, are shown on the following page.

The image is quite effective when used with a TV vectorscope to see how a video system handles an encoded color signal.The image consists of a white crosshatch on a black background. The lines form square boxes when the display's active video area has a 4:3 aspect ratio. The vertical lines are made using sine-squared (2 T) pulses (T = 125 nSec for NTSC and T = 100 nSec for PAL).



Test Convergence adjustment

Purpose To accurately produce an image on a color monitor, the three electron beams in the CRT must meet (converge) at the same location at the same time. Lines displayed on a mis-converged monitor will appear as several multi-colored lines, and the transitions between different colored areas will contain "fringes" of other colors.

Method The convergence adjustments of most color monitors can be divided into two main categories. The first set of adjustments, usually called "Static Convergence," calls for aligning the three beams in the center of the display. This method involves turning on all three guns and adjusting the various magnets on the convergence assembly to produce all white lines and dots in the center of the display. The convergence assembly is located on the neck of the CRT. Different monitors and CRT types may each require their own magnet adjustment sequence.

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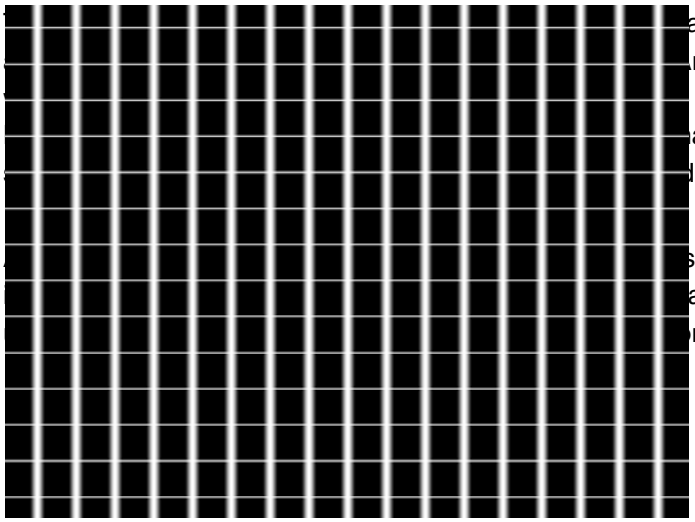
After the center of the display is properly converged, the outer areas can be adjusted by using the monitor's "Dynamic Convergence" controls. The number of controls, the area of the screen that they affect and their adjustment procedure is dependent upon the monitor under test.

Test Sweep linearity adjustment

Purpose



al sweeps of the electron beam
ny non-uniformity in the sweep
portions will be compressed.
ay be present across the entire
in a very small area.

Method

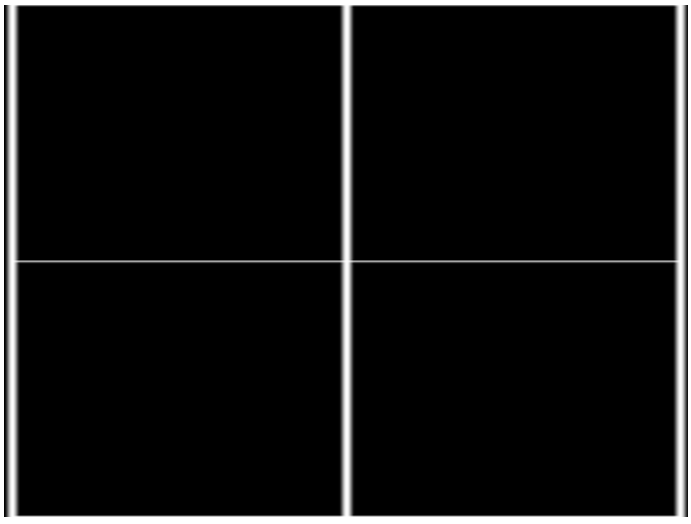
s in the crosshatch are identical
auge made for the monitor
n limits.

Taffeta

Description

TVoutLin

Description Equivalent to Outline1 image but it uses anti-aliasing for vertical bars and double horizontal lines, which reduces flickering.



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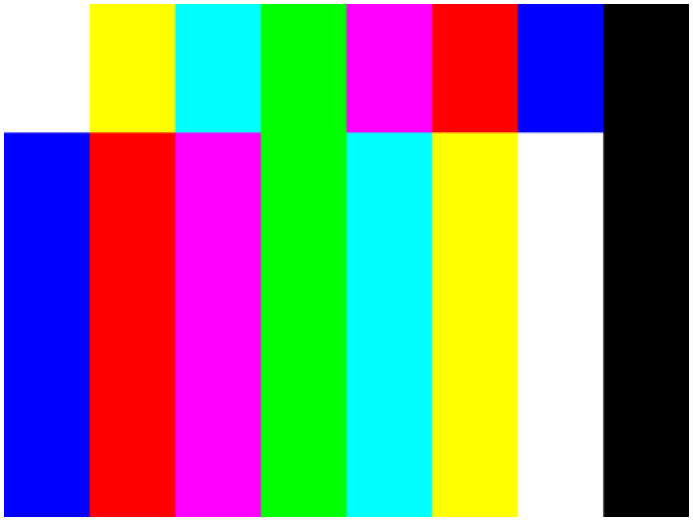
TVSplBar

Description Special test image developed per customer specifications.



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C Error Messages

Topics in this appendix:

- System errors
- Format errors
- Error code descriptions

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System errors

This section discusses system error messages that may be displayed by the generator from time to time.

Power-on self test messages

The integrity of the data stored in non-volatile memory is checked every time the generator is turned on. The following tests are performed:

1. The system configuration memory is checked. The memory remembers what the generator was doing when it was last powered down. The memory also stores all system wide parameters such as calibration factors and the light meter size. It is also checked to see if it is compatible with the current version of operating firmware. If everything is in order, then the generator goes on to step 2.

   Otherwise, a “System corrupt!” message is displayed for 2 seconds. This message is immediately followed by a “Memory blank” message, which is displayed for 2 seconds while the format memory is re-initialized. Memory initialization involves clearing the entire non-volatile memory and loading it with factory default data. Any and all data created or edited by the user will be wiped out. The calibration factors are restored to the original values used at the factory to test and calibrate the unit. The generator then continues with step 3.

   Note: *System corruption is rare, and may be an indication of a bad memory backup battery or a damaged generator.*

   Note: *If you update the firmware EPROM in your unit, your system will appear to be corrupt at the next power-on.*

2. The remainder of non-volatile memory is checked to see if any data has been corrupted since the last time the generator was used. This check includes each of the 300 format storage locations. All user created custom images and test sequences are also checked. If no problems are found, the generator goes on to step 3.

   If one (or more) items have been corrupted, a message containing a tally of the defective items is displayed for 2 seconds. A message for two corrupted items is shown here. Please note that the checking routine does not identify the types of items (format,

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custom image or test sequence) that are corrupted. It is up to the user to check the contents of the individual items. Attempting to load a corrupted item will report and error for that item.

A corrupted format can be repaired be either editing it or by downloading a new set of data from a computer.

In most cases, a corrupted custom image or test sequence can not be repaired. This is due to the variable data structure used. You will need to recreate and save the data back into memory.

Repeated corruption of the data in non-volatile memory usually indicates a weak battery. Battery replacement information can be found in the chapter on Maintenance.

3. A power-on message, indicating the current firmware and hardware revision levels, will appear for 2 seconds at the end of the self test procedure.

   If an animated image is displayed at power on, this message will not disappear until a button is pushed or a knob is turned.

Power fail message

Whenever the AC power line voltage dips below the minimum specified, this message is displayed and the generator's microprocessor is halted.

If you see this message during normal operation, it probably indicates that a power sag or short duration drop-out has occurred. To clear this condition, cycle the power going to the generator. If the power is good, the generator should resume normal operation. If you still have a problem, you may also want to check to see that the line voltage selector (next to the power inlet) is set correctly for the power being fed into the generator.

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Format errors

Under normal operating conditions, a properly programmed model 801GX generator should never report any Format error messages. If you do get an error message while loading a format it is for one of two reasons. The generator distinguishes between invalid data, entered in one of the programming modes, and corrupted data caused by a memory failure. In either case, the generator will shut all of its outputs off. The outputs remain off until a valid format is loaded.

Invalid data error messages

The example on the left shows a typical invalid data error message. The top line of the display shows the format's storage location number and name. The bottom line shows the error number. Error numbers will be in the range of 2000 through 2999. Different numbers indicate what type invalid data or combination of data is causing the error.

The following pages explain the cause of each of the error numbers and offers suggestions on how to correct the problem.

Corrupt data error messages

The example on the left shows a corrupted data error message. The top line of the display shows the format's storage location number and name. The bottom line shows the error number. Error number 9450 identifies the cause of the error as corrupted data. This type of error either indicates the signs of a failing memory backup battery or a more serious hardware failure in the generator.

Corrupted formats can corrected by either editing them or by downloading a clean copy of the format from a computer. The "Programming" chapter explains both methods in detail.

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Error code descriptions

2000-2999 Format errors

2030 Number of fields per frame less than 1

A valid video format must have at least one (1) vertical filed of video per frame.

2040 Number of fields per frame greater than 2

The generator hardware configuration does not support interlaced video formats having more than two (2) vertical fields per frame.

2041 Can not repeat field if progressive

Repeat field operation is only supported in interlaced video formats.

2050 Horizontal total too small

The video format's total (active + blanked) number of pixel clock cycles per horizontal scan line is below the minimum number supported by the generator hardware configuration.

2060 Horizontal total too large

The video format's total (active + blanked) number of pixel clock cycles per horizontal scan line is greater than the maximum number supported by the generator hardware configuration.

2071 Pixel rate too high

The video format's total (active + blanked) number of pixel clock cycles per horizontal scan line multiplied by the horizontal scan rate exceeds the maximum pixel clock frequency supported by the generator hardware configuration for the format's video type.

2072 Pixel clock rate too high for pixel depth

The video format's pixel depth combined with the total (active + blanked) number of pixel clock cycles per horizontal scan line and horizontal scan rate exceeds the maximum internal video data bit rate supported by the generator hardware configuration. The pixel depth and/or total number of pixels per line need to be reduced in order to keep the current horizontal scan rate.

2073 Pixel rate justification too high

The target pixel clock rate selected for justification of the video format exceeds the generator hardware configuration.

2074 Pixel depth not supported

The video format's pixel depth is not supported by the generator hardware configuration.

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2075 Analog composite sync type not supported

The video format's analog video composite sync type selection is not supported by the generator hardware configuration.

2076 Digital sync composite type not supported

The video format's digital composite sync type selection is not supported by the generator hardware configuration.

2077 Number of digital links not allowed

The number of serial digital video data links in the video format exceeds the number of links supported by the current firmware.

2078 Digital sync separate type not allowed for HDTV formats

The generator hardware configuration does not support digital separate sync for the specific video type selection in the video format

2079 Number of links not supported

The number of serial digital video data links in the video format exceeds the number of links supported by the generator hardware configuration.

2080 Pixel rate too low

The video format's total (active + blanked) number of pixel clock cycles per horizontal scan line multiplied by the horizontal scan rate is less than the minimum pixel clock frequency supported by the generator hardware configuration for the format video type.

2082 Number of bits not allowed

The generator hardware configuration does not support the number of data bits per color for the serial digital video type selected in the video format.

2083 Invalid quantizing mode

An invalid value has been specified for the DVQM parameter.

2084 Invalid Pixel Repetition

In digital mode, double clocking is not supported for this specific hardware. This error may be the result of an older FPGA or hardware.

2085 Invalid Sampling Mode

The value specified for DVSM is not valid and is inconsistent with the setting of DVST.

2090 Horizontal total not even

The generator hardware configuration does not support interlaced video formats with a total (active + blanked) number of pixel clock cycles per horizontal scan line that is not evenly divisible by 2.

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-OR-

The generator hardware configuration does not support a video format with a total (active + blanked) number of pixel clock cycles per horizontal scan line that is not evenly divisible by 2 for the selected analog or digital composite sync type.

2091 Horizontal total not a multiple of 4

The generator hardware configuration does not support a video format with a total (active + blanked) number of pixel clock cycles per horizontal scan line that is not evenly divisible by 4. Mostly applies to video formats using serial digital video.

2092 Horizontal resolution not even

Number of active pixels per line must be evenly divisible by 2 for the given video format type and generator hardware configuration.

2093 Horizontal sync pulse width not even

Number of pixel clock cycles in the horizontal sync pulse width must be evenly divisible by 2 for the given video format type and generator hardware configuration.

2094 Horizontal sync pulse delay not even

The number of pixel clock cycles in the horizontal sync pulse delay must be evenly divisible by 2 for the given video format type and generator hardware configuration.

2096 Horizontal resolution not a multiple of 4

The generator hardware configuration does not support a video format with a number of active pixels per horizontal scan line that is not evenly divisible by 4. Mostly applies to video formats using serial digital video.

2097 Horizontal sync pulse width not a multiple of 4

The generator hardware configuration does not support a video format with the number of pixel clock cycles in the horizontal sync pulse width not evenly divisible by 4. Mostly applies to video formats using serial digital video.

2098 Horizontal sync pulse delay not a multiple of 4

The generator hardware configuration does not support a video format with the number of pixel clock cycles in the horizontal sync pulse delay not evenly divisible by 4. Mostly applies to video formats using serial digital video.

2099 JRAT greater than 200MHz not allowed

The 802BT generator does not support a setting of JRAT greater than 200MHz.

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2130 Horizontal active too small

The number of active pixels per horizontal scan line is less than the minimum supported by the generator hardware configuration.

2140 Horizontal blanking too small

The video format's horizontal blanking period expressed in microseconds and/or number of pixel clock cycles is not supported by the generator hardware configuration.

2141 Horizontal blanking too small

Same as Error number 2140. Found in some firmware releases for different generator hardware configurations.

2150 Horizontal blanking too small

Same as Error number 2140. Found in some firmware releases for different generator hardware configurations.

2151 Horizontal total less than horizontal resolution

The video format's total (active + blanked) number of pixel clock cycles per horizontal scan line can not be less than the number of active pixels per scan line.

2152 Horizontal resolution too large or Horizontal blanking too small

Same as Error number 2140. Found in some firmware releases for different generator hardware configurations.

2155 Horizontal blanking too small

Same as Error number 2140. Found in some firmware releases for different generator hardware configurations.

2180 Horizontal pulse width too small

The generator hardware configuration does not support video formats having horizontal sync pulse widths less than one pixel clock cycle long.

2181 Horizontal sync pulse width not even

Number of pixel clock cycles in the horizontal sync pulse width must be evenly divisible by 2 at the current pixel clock rate for the video format and generator hardware configuration.

2190 HSPW too small for HDTV sync

The generator hardware configuration does not support video formats having horizontal sync pulse widths less than two pixel clock cycles long for the current video and HDTV sync type selections.

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2191 HSPW must be even for HDTV sync

The number of pixel clock cycles in the horizontal sync pulse width must be evenly divisible by 2 for the current video and HDTV sync type selections.

2200 Horizontal pulse width too large

The generator hardware configuration does not support a horizontal sync pulse width that is greater than the horizontal blanking period.

2201 Horizontal pulse delay not even.

The number of pixel clock cycles in the horizontal sync pulse delay must be evenly divisible by 2 at the current pixel clock rate for the video format and generator hardware configuration.

2205 Frame sync pulse width too small

The generator hardware configuration does not support a Frame Sync pulse width less than horizontal scan period.

2206 Frame sync pulse width too large

The Frame Sync pulse width can not be greater than the total (active + blanked) number of horizontal scan lines in one frame of video.

2207 Probe sync pulse width too small

The probe sync pulse width is less than minimum supported by the generator hardware configuration.

2208 Probe sync pulse width too large

The probe sync pulse width is greater than maximum supported by the generator hardware configuration.

2230 Horizontal pulse delay extends sync beyond blanking

The generator hardware configuration does not support the video format's combination of horizontal sync pulse delay and pulse width that places any portion of the horizontal sync pulse outside of the horizontal blanking period.

2231 Vertical serration adjustment too big

The video format's HVSA setting beyond the maximum limit for the video type selected and generator hardware configuration.

2240 Vertical total too small

The total (active + Blanked) number of horizontal scan lines per frame a progressive scan (non-interlaced) video format is lees than the minimum supported by the generator hardware configuration.

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2250 Vertical total too small for interlaced format

The total (active + blanked) number of horizontal scan lines per frame is less than the minimum number supported by the generator hardware configuration.

2270 Vertical total is even

The generator hardware configuration does not support interlaced scan video formats having an even total (active + blanked) number of horizontal scan lines per frame.

2280 Vertical total too large

The total (active + blanked) number of horizontal scan lines per frame exceeds the maximum limit for the generator hardware configuration.

2300 Vertical active too small

The active number of horizontal scan lines per frame of a progressive scan (non-interlaced) video format is less than the minimum supported by the generator hardware configuration.

2310 Vertical blanking too small

The number of blanked horizontal scan lines per frame for a progressive scan (non-interlaced) video format is less than the minimum supported by the generator hardware configuration.

2320 Vertical active too small for interlaced format

The active number of horizontal scan lines per frame of an interlaced video format is less than the minimum supported by the generator hardware configuration.

2321 Vertical active not even

The generator hardware configuration does not support interlaced scan video formats having an odd active number of horizontal scan lines per frame.

2330 Vertical blanking too small for interlaced format

The number of blanked horizontal scan lines per frame for an -interlaced video format is less than the minimum supported by the generator hardware configuration.

2350 Vertical pulse too small

The vertical sync pulse width is less than the minimum supported by the generator hardware configuration.

2370 Vertical pulse too large

The vertical sync pulse width is greater than the maximum supported by the generator hardware configuration.

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2390 Vertical pulse too large for interlaced format

The vertical sync pulse width combined with the number of pre and post-equalization pulses for an interlaced format is greater than the maximum supported by the generator hardware configuration.

2391 Incompatible analog composite sync & digital composite sync types

The generator hardware configuration does not support the video format outputting both analog composite sync and digital composite sync type selections at the same time.

2392 Incompatible analog composite sync & digital separate sync types

The generator hardware configuration does not support the video format outputting both analog composite sync and digital separate sync type selections at the same time.

2393 Analog composite sync type not compatible with analog video type

The generator hardware configuration does not support the video format's analog composite sync type being added to the current analog video type.

2394 ACS available on green only

The generator hardware configuration supports adding analog composite sync to only the green analog video output

2395 Sync type selection incompatible with analog video type selection

The video format's analog video type selection requires the use of analog composite sync.

2396 Invalid analog composite sync type

The current firmware does not support the format's analog composite sync type parameter value (ASCT setting) or the generator hardware configuration does not support a video format's analog composite sync type for non-interlaced operation.

2397 Invalid digital composite sync type

The current firmware does not support the format's digital composite sync type parameter value (DSCT setting) or the generator hardware configuration does not support a video format's digital composite sync type for non-interlaced operation.

2398 Invalid digital separate sync type

The current firmware or generator hardware configuration does not support the format's digital separate sync type parameter value (DSST setting)

2399 Invalid sync type selection

The current firmware does not support the format's active sync type selection (SSST setting).

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2400 Analog composite sync type and digital separate sync type incompatible

The generator hardware configuration does not support analog composite sync and digital separate sync being active at he same time for the given analog composite sync type parameter value (ASCT setting) and digital separate sync type parameter value (DSST setting).

2401 Invalid horizontal sync pulse delay

The generator hardware configuration does not support the format's current horizontal sync pulse delay setting

2405 Frame sync pulse delay negative

The video format's frame sync pulse delay setting must be zero or a positive number.

2406 Frame sync pulse delay too large

The video format's frame sync pulse delay setting exceeds the maximum limit supported by the generator hardware configuration.

2407 Negative probe sync pulse vertical delay

The video format's probe pulse vertical delay setting must be zero or a positive number.

2408 Probe sync pulse vertical delay too large

The video format's probe pulse vertical delay setting exceeds the maximum limit supported by the generator hardware configuration.

2409 Negative probe sync pulse horizontal delay

The video format's probe pulse horizontal delay setting must be zero or a positive number.

2410 Probe sync pulse horizontal delay too large

The video format's probe pulse horizontal delay setting exceeds the maximum limit supported by the generator hardware configuration.

2425 Sync type selection not supported

The current firmware does not support the video format's active sync type selection (SSST setting) or the active sync type selection is not supported by the current analog video type selection (AVST setting).

2430 Vertical pulse delay extends sync beyond blanking

The generator hardware configuration does not support non-interlaced video formats having a vertical sync pulse period greater that the vertical blanking period

2450 Vertical pulse delay extends sync beyond blanking

The generator hardware configuration does not support interlaced video formats having a vertical sync pulse period greater that the individual blanking periods between the fields.

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2465 Pixel clock pulse gate = 1 and pixel depth = 8

The generator hardware configuration does not support outputting a pixel clock output when the video format's pixel depth is eight bits-per-pixel.

2466 Pixel clock pulse gate = 1 not allowed

The generator hardware configuration does not support a pixel clock output.

2490 EQ before too large

The video format's number of lines of pre-equalization for analog or digital composite sync must not exceed the number of lines of vertical sync pulse delay.

2495 EQ after too large for interlaced format

The interlaced video format's number of lines of post-equalization for analog or digital composite sync must not exceed the number of scan lines from the end of the vertical sync pulse to the start of video for either field.

2496 EQ after too large

The non-interlaced video format's number of lines of post-equalization for analog or digital composite sync must not exceed the number of scan lines from the end of the vertical sync pulse to the start of video.

2550 Not enough video memory

The generator hardware configuration does not have enough video memory to support the video format's combination of active pixels per line (HRES setting) and active lines per frame (VRES setting).

2551 Insufficient memory

Not implemented at the time this document was created.

2553 No PCMCIA card found in drive

When attempting to download a bitmap no PCMCIA card was detected in the generator's PCM slot.

2554 PCMCIA card is write-protected

When attempting to download a bitmap to a PCMCIA card, the PCM card was write-protected.

2555 PCMCIA card is bad

When attempting to download a bitmap to a PCMCIA card, the PCM card was found to be bad.

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2704 Invalid horizontal physical size

The video format's horizontal physical size value can not be negative.

2705 Invalid physical size units

The current firmware does not support the type number used for the video format's units of measure for physical size (USIZ setting).

2706 Invalid vertical physical size

The video format's vertical physical size value can not be negative.

2714 Pedestal swing out of range

The video format's blanking pedestal level (AVPS setting) can not be less that 0.0% of the peak video level or more than 100.0% of the peak video level.

2715 Gamma correction out of range

The current firmware does not support a video format's gamma correction factor (GAMA setting) of less than 0.1 or greater than 10.

2716 Analog video swing out of range

The generator hardware configuration does not support the video format's analog video swing value (AVSS setting) for the given analog video type selection.

2717 Sync swing out of range

The generator hardware configuration does not support the video format's analog video composite sync swing value (ASSS setting) for the given analog video type selection.

2719 Video swing calibration out of range

The generator hardware configuration does not support the current user defined analog video swing calibration factors (AVSC settings) for one or more of the red, green or blue channels. The valid factory default setting is 1.00 for all three channels.

2720 Sync swing calibration out of range

The generator hardware configuration does not support the current user defined analog video composite sync swing calibration factors (ASSC settings) for one or more of the red, green or blue channels. The valid factory default setting is 1.00 for all three channels.

2721 NTSC TV signals require blanking pedestal

The generator hardware configuration does not support producing NTSC TV video outputs that do not use a blanking pedestal (AVPG setting of 0) as required by the NTSC specifications.

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2722 Blanking pedestal out of range for NTSC TV signal

The generator hardware configuration does not support producing NTSC TV video outputs that do not use a nominal blanking pedestal level (AVPS setting) of 7.5 IRE as required by the NTSC specifications.

2741 Digital video signal type not supported

The generator hardware configuration does not support any type of digital video outputs.

2742 Invalid digital video signal type

The current firmware does not support the format's digital video type selection (DVST setting).

2743 Digital video polarity not positive

The generator hardware configuration and/or the firmware does not support digital video formats having a logic low level for the active (lit) pixels.

2745 Can not have analog AND digital video

The generator hardware configuration does not support the simultaneous generation of analog and digital video signals.

2747 Invalid analog video signal type

The current firmware for a given model generator does not support the video format's analog video type selection.

2748 Analog video signal type not supported

The generator hardware configuration does not support the video format's analog video type selection.

2760 Digital video not supported

The generator hardware configuration does not support the video format's digital video type selection.

2761 Digital video signal swing out of range

The value specified for the digital video signal swing is out of range.

2762 Digital video swing calibration out of range

The value specified for the digital video swing calibration is out of range.

2800 Pseudo-random noise seed value exceeds limit

The seed value for the pseudo-random noise analysis exceeds its maximum value.

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2801 Pseudo-random noise sequence exceeds limit

The length of the pseudo-random noise sequence exeeds maximum value.

2802 Pseudo-random noise type is not supported

The pseudo-random noise type is not supported.

2803 No signal input to analyzer

There is no signal input to the receive interface of the analyzer.

2804 X coordinate for delta patch out-of-range

The value specified for the X coordinate of the delta patch test is out-of-range.

2805 Y coordinate for delta patch out-of-range

The value specified for the Y coordinate of the delta patch test is out-of-range.

2806 Patch height must be greater than one

The patch height specified for a delta error test must be greater than one.

3000-3999 Image errors

3000 Invalid color name

The current firmware does not support a named color used by one or more primitives in the user defined custom image

3001 Invalid pattern name

The current firmware does not support a named fill patterns used by one or more primitives in the user defined custom image

3002 No image memory

There is not enough unused edit buffer memory space available to start a new custom image editing session.

3004 Invalid font name

The current firmware does not support a named font used by one or more primitives in the user defined custom image

3005 Image editor running

The current firmware does not allow a new custom image editing session to be started while the current custom image editing session is still running.

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3006 Nothing to save

An attempt was made to save the contents of a custom image editing buffer when there was no open custom image editing session to save.

3007 Overwrite ROM Image

A user defined test image can not be saved using the same name as that of a built-in test image (case insensitive).

3008 Image save failed

Saving the contents of the custom image editing buffer failed for a reason other than those reported by error codes 3005 or 3006.

3010 R, G or B 8-Bit video DAC setting out of range

A combination of system calibration factors, user calibration multiplier settings and video output level settings have resulted in one or more calculated input values to go below zero or above the analog video Digital-to-Analog Converter's maximum limit of 255.

3011 R, G or B 6-Bit video DAC setting out of range

A combination of system calibration factors, user calibration multiplier settings and video output level settings have resulted in one or more calculated input values to go below zero or above the analog video Digital-to-Analog Converter's maximum limit of 63.

3015 R, G or B 10-Bit video DAC setting out of range

A combination of system calibration factors, user calibration multiplier settings and video output level settings have resulted in one or more calculated input values to go below zero or above the analog video Digital-to-Analog Converter's maximum limit of 1023.

3020 Kill EPROM image

Built in test images can not be removed from the firmware.

3025 Image not found

A test image of a given name could not be found as either a built-in test image in the firmware or as a user defined custom image.

3050 Grayscale video DAC setting out of range

One or more internal calculations have resulted in an analog video DAC input grayscale setting below zero or greater than 100% video level.

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4000-4999 Test sequence errors

4000 Invalid format name

The test sequence contains one or more steps that have an invalid format name parameter.

4001 Invalid image name

The test sequence contains one or more steps that have an invalid image name parameter.

4002 No sequence memory

There is not enough unused edit buffer memory space available to start a new test sequence editing session.

4003 Sequence memory full

There is not enough free battery backed user storage memory to save the sequence that is in the edit buffer.

4004 Sequence not found

A test sequence of the given name could not be found in the user storage memory area.

4005 Sequence editor running

The current firmware does not allow a new test sequence editing session to be started while the current test sequence editing session is still running.

4006 No sequence to save

An attempt was made to save the contents of a test sequence editing buffer when there was no open test sequence editing session to save.

4007 Sequence buffer full

No more steps can be added to the current sequence being edited because no more edit buffer space is available.

4008 Invalid delay setting in sequence

The test sequence contains one or more steps that have a negative number for the step delay time.

4010 Font index out of range

An attempt was made to use a font at an index location that is less than zero (0) or greater than the highest index number in use.

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4020 No font present at given index

Attempt to access a font at a valid index but the specified index is empty because of a previous delete.

4030 Invalid font location

Can not install a font that has not first been transferred to memory.

4040 Sequence is running

A sequence editing session can not be started while a sequence is running.

4045 No sequence buffer

An attempt was made to change a parameter in a sequence step when there were no sequence steps in the current sequence being edited.

4100 Pattern index out of range

The selected index number for a drawing primitive's fill pattern is less than zero or greater than the highest number used by the current firmware.

4576 Can not convert to inches, not valid units

The format's current physical units of measure (inches or millimeters) is unknown and the firmware is unable to convert a dimension to inches.

4579 Can not convert to mm, not valid units

The format's current physical units of measure (inches or millimeters) is unknown and the firmware is unable to convert a dimension to millimeters.

5000-5999 Directory errors

5002 No directory memory

The DIRN or NAMI command failed because there is an insufficient amount of managed memory for the buffer request.

5003 Directory memory full

The DIRA or DIRS command failed because there is insufficient room in the directory memory pool for the requested save.

5006 No directory to save

An attempt was made to save the contents of a directory editing buffer when there was no open directory editing session to save.

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5009 Directory list full

This occurs during DIRA and DIRS commands when attempting to save more directories than supported by the current firmware.

5010 Invalid name index

The value of the <index> parameter used for a NAMQ? query is can not be zero(0).

6000-6999 Bitmap errors

6006 No map to save

An attempt was made to save the contents of a bit map editing buffer when there was no open bit map editing session to save.

6020 Map not found

An attempt was made to access a bit map whose name can not be found in the generator's list of currently stored bitmaps

6030 Invalid map dimensions

A bit map can not have a horizontal or vertical dimension of less than one (1) pixel.

6035 Invalid map depth

The current firmware and/or generator hardware configuration does not support pixel depth setting of the selected bit map.

6036 Map data index

An attempt was made to recall a bit map at an index location that is less than zero (0) or greater than the highest index number in use for bit maps.

7000-7999 LUT errors

7006 No LUT to save

An attempt was made to save the contents of a color lookup table editing buffer when there was no open color lookup table editing session to save.

7010 No LUT buffer

An attempt was made to modify the contents of a color lookup table editing buffer when there was no open color lookup table buffer available.

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7011 Invalid LUT Index

An attempt was made to recall a color lookup table at an index location that is less than zero (0) or greater than the highest index number in use for color lookup tables.

7020 LUT not found

8000-8999 Font errors

8450 Cannot remove font. Font not found.

Attempt to use FNTK command to delete a nonexistent font by name.

8455 Cannot remove built-in font

Attempt to use FNTK command to delete a built-in font.

8460 Font already exists in memory

Attempt made to transmit a font to the generator which already contained a font with the same name.

9000-9999 System errors

9450 Corrupted format

Checksum error in data for a particular video format

9451 Bad location for format, failed verify

This occurs during FMTV command and FMTV? query when you attempt to verify data integrity at an invalid location.

9452 Bad location for format verify

This occurs during a FMTZ? query when you try to determine if an invalid location has been erased.

9453 Kill EPROM format

Can not delete factory default formats stored in EPROM

9453 Can not change EPROM contents

This occurs during FMTW or FMTZ commands when you try to overwrite or zero out an EPROM format.

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9454 Bad location for format erase

This occurs during FMTE command when you try to access an invalid format memory location.

9456 Bad location for format read/write

This occurs during FMTR or FMTW commands when you try to read or write to an invalid format memory location.

9457 Bad location for format name read

This occurs during FMTR? query when you try to read or write to an invalid format memory location.

9458 Bad location for format copy

This occurs during FMTD command when you try during copying to access an invalid format memory location.

9459 Can not change EPROM contents

This occurs during FMTD command when you try during copying to overwrite an EPROM format.

9460 Bad location for format duplicate

This occurs during FMTD and FMTI commands when you try to use one or more invalid format memory locations as the command arguments.

9467 Bad location for format erase

This occurs during FMTZ command when you try to make one or more invalid format memory locations as the command arguments.

9470 Can not change EPROM contents

An attempt was made to insert a format using the FMTI command into an EPROM format memory location.

9471 Bad location for format yank

This occurs when you try to remove (yank) one or more formats from invalid format memory locations using the FMTY command.

9472 Can not change EPROM contents

This occurs when you try to remove (yank) one or more formats from EPROM format memory locations using the FMTY command.

9475 Can not change EPROM contents

One or more EPROM format locations was given as the destination location for the FMTD command.

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9477 Error duplicating formats

The <first> memory location parameter used with the FMTD command is greater than the <last> memory location parameter.

9480 Format not found / Format data missing

The FMTR command tried to read a format from an empty format storage location.

9490 DDC mod not present

The generator hardware configuration does not support DDC communications.

9491 DDC not available

The generator hardware configuration does not support DDC communications.

9492 DDC2B no ACK from receiver

Low level DDC communications failed with Unit Under Test (UUT). No DDC acknowledgment bit was received from the UUT.

9493 DDC2B arbitration lost

Low level DDC communications failed with Unit Under Test (UUT). DDC bus arbitration lost with the UUT.

9494 DDC2B timeout on bus

Low level DDC communications failed with Unit Under Test (UUT). DDC communications timed out with the UUT.

9496 EDID header not found

A valid block of header data could not be found in the EDID data read back from Unit Under Test (UUT).

9497 DDC old monitor

A DDC compliant Unit Under Test (UUT) could not be found connected to the generator.

9498 I2C address missing

There was a communications error within the generator hardware architecture because the device address was missing.

9499 I2C count missing

There was a communications error within the generator hardware architecture because the data count was missing.

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9500 I2C stream too big

There was a communications error within the generator hardware architecture because the data stream size exceeded the size supported by the device.

9500 Sequence data not found

An attempt was made to use the SEQR command to read a sequence from an empty sequence storage location.

9501 I2C data missing

There was a communications error within the generator hardware architecture because the device data stream was missing.

9502 I2C register missing

There was a communications error within the generator hardware architecture.

9503 I2C data byte missing

There was a communications error within the generator hardware architecture because the device data stream had missing data.

9504 Serial digital video PLL not locked

There is an internal problem with the generator's serial digital video hardware's Phase Lock Loop circuit.

9505 TV output hardware not ready

The generator's serial digital video generating hardware is not yet ready to output video

9506 Serial digital video hardware not ready

The generator's TV signal generating hardware reports it is not yet ready to output valid video

9507 I2C offset missing

There was a communications error within the generator hardware architecture

9508 Invalid HDCP receiver KSV

The HDCP Key Selection Vector returned from the HDCP receiver in the Unit Under Test (UUT) is not valid.

9520 HDCP key combination not supported

The HDCP key combination between the Tx and the Rx is invalid. The Tx may have production keys and the Rx public keys.

9521 HDCP failed after a while

The HDCP authentication started but failed after a while.

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9522 HDCP key combination not supported

The HDCP authentication did not start.

9523 HDCP production keys not supported

HDCP test initiated and specified production keys where are not supported in generator option.

9524 Invalid transmitter KSV

HDCP video transmitter KSV sent by the generator is invalid.

9525 HDCP Ri value not ready

HDCP authentication cannot start because HDCP Ri value (link verification response) at the transmitter is not ready.

9527 HDCP Ri do not match

HDCP authentication cannot start because HDCP Ri (link verification response) values at the transmitter and receiver do not match.

9528 HDCP was interrupted

HDCP authentication was interrupted possibly by disconnecting the cable.

9529 HDCP receiver not detected

HDCP authentication failed to start because the hot plug was not detected.

9530 HDCP invalid for animation

HDCP test will not run when an animated image is loaded.

9531 I2C segment number missing

The segment number of the enhanced DDC bus is missing.

9532 I2C address 1 missing

The first address of the enhanced DDC bus is missing.

9533 I2C address 2 missing

The second address of the enhanced DDC bus is missing.

9600 Can not save format to EPROM

An attempt was made to save a format edit buffer's contents to a location in the firmware EPROM.

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10000-10999 System errors

10000 Out of memory

There is not enough unused battery backed user memory space to store the contents of the given edit buffer

10010 Invalid file check sum

The data object file that has been recalled from the generator's memory contains an invalid checksum. Data may be corrupted.

10020 Invalid file version

The data object file that has been recalled from memory contains a file version number that does not match the current firmware. Data may not be properly interpreted by the firmware

10025 File type

The data object file that has been recalled from memory contains a file type identification that is not supported by the current firmware.

10026 File size

The size of the data object file that has been recalled from memory does not match the size information stored in the file's header data.

10030 Feature not implemented

The generator hardware configuration does not support one or more settings in the video format

10035 Video board not detected

An attempt was made to reprogram the firmware Flash EPROMs in a Model 822 series generator without a video board installed. The video board's memory is used as a buffer for the initial uploading of the firmware data.

10100 Filename alias not found

An attempt was made to delete a filename alias that does not exist.

10200 Font not overwriteable

An attempt was made to save the contents of a font editing buffer to a location in the firmware EPROM.

10205 Font save failed

There is not enough unused battery backed user memory space to store the contents of the font editing buffer.

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10210 Font table range

The recalled font data object contains a reference to a nonexistent table in the data object.

10215 Font table Index range

The recalled font data object contains a reference to a nonexistent location in one of the tables in the data object.

10220 Font not found

An attempt was made to recall a font by name that is not stored in the generator.

10225 Can not delete font in EPROM

Ann attempt was made to delete a font stored in the firmware EPROM.

10230 Invalid font check mode

The current firmware does not support the selected test method on the contents of the font edit buffer.

10235 No font definition

The recalled font does not contain valid font definition data need to determine the size needed by the edit buffer.

10240 Font character high range

The character height setting of the font in the edit buffer is less than one or greater than the maximum supported by the current firmware.

10241 Font ascent descent sum

The character height setting of the font in the edit buffer is does not match the sum of the character ascent and descent settings

10242 Invalid font character range

The first or last character number setting of the font in the edit buffer is greater than the maximum supported by the current firmware or the number of the first character is greater than the number of the first character.

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